August 1980 $2.95

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the first in synthesized portables gives you the broadest choice at the lowest price

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TEMPO
FM Transceiver — S5

Shown with optional touch tone pad

- ✻ The only synthesized hand-held offering 5 watts output. (Switchable for 1 or 5 watt operation)
- ✻ The same dependability as the time proven S-1. Circuitry that has been proven in more than a million hours of operation.
- ✻ Heavy duty battery pack.
- ✻ External microphone capability.
- ✻ The S-5's exciting low price...only $299.00
- ✻ With touch tone pad $339.00

SPECIFICATIONS

Frequency Coverage:	144 to 148 MHz
Channel Spacing:	Receive every 5 kHz, transmit Simplex or ± 600 kHz
Power Requirements:	9.6 VDC
Current Drain:	17 ma-standby 900 ma-transmit
Antenna Impedance:	50 ohms
Dimensions:	40 mm x 62 mmx 170 mm (1.6" x 2.5" x 6.7")
Weight:	17 oz.
Sensitivity:	Better than .5 microvolts nominal for 20 db

SUPPLIED ACCESSORIES
Telescoping whip antenna, ni-cad battery pack, charger.

OPTIONAL ACCESSORIES
12 Button touch tone pad (not installed): $39 • 16 Button touch tone pad (not installed): $48 • Tone burst generator: $29.95 • CTCSS sub-audible tone control: $29.95 • Rubber flex antenna: $8 • Leather holster: $16 • Cigarette lighter plug mobile charging unit: $6 • Matching 30 watt output 13.8 VCD power amplifier (S30): $89 • Matching 80 watt output power amplifier (S80): $149

The new improved Tempo S-1

- The first and most thoroughly field tested hand-held synthesized radio available. 800 channels in the palm of your hand.
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- Heavy duty battery pack allows more operating time between charges.
- External microphone capability
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The Tempo line also features a fine line of extremely compact UHF and VHF pocket receivers. They're low priced, dependable, and available with CTCSS and 2-tone decoders.
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The Tempo S-2

Tempo is first again. This time with a superior quality synthesized 220 MHz hand held transceiver. With an S-2 in your car or pocket you can use 220 MHz repeaters throughout the U.S. It offers all the advanced engineering, premium quality components and exciting features of the S-1. The S-2 offers 1000 channels in an extremely lightweight but rugged case.

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2W	80W	80A02	$169
10W	80W	80A10	$149
30W	80W	80A30	$159
2W	50W	50A02	$129
2W	30W	30A02	$ 89

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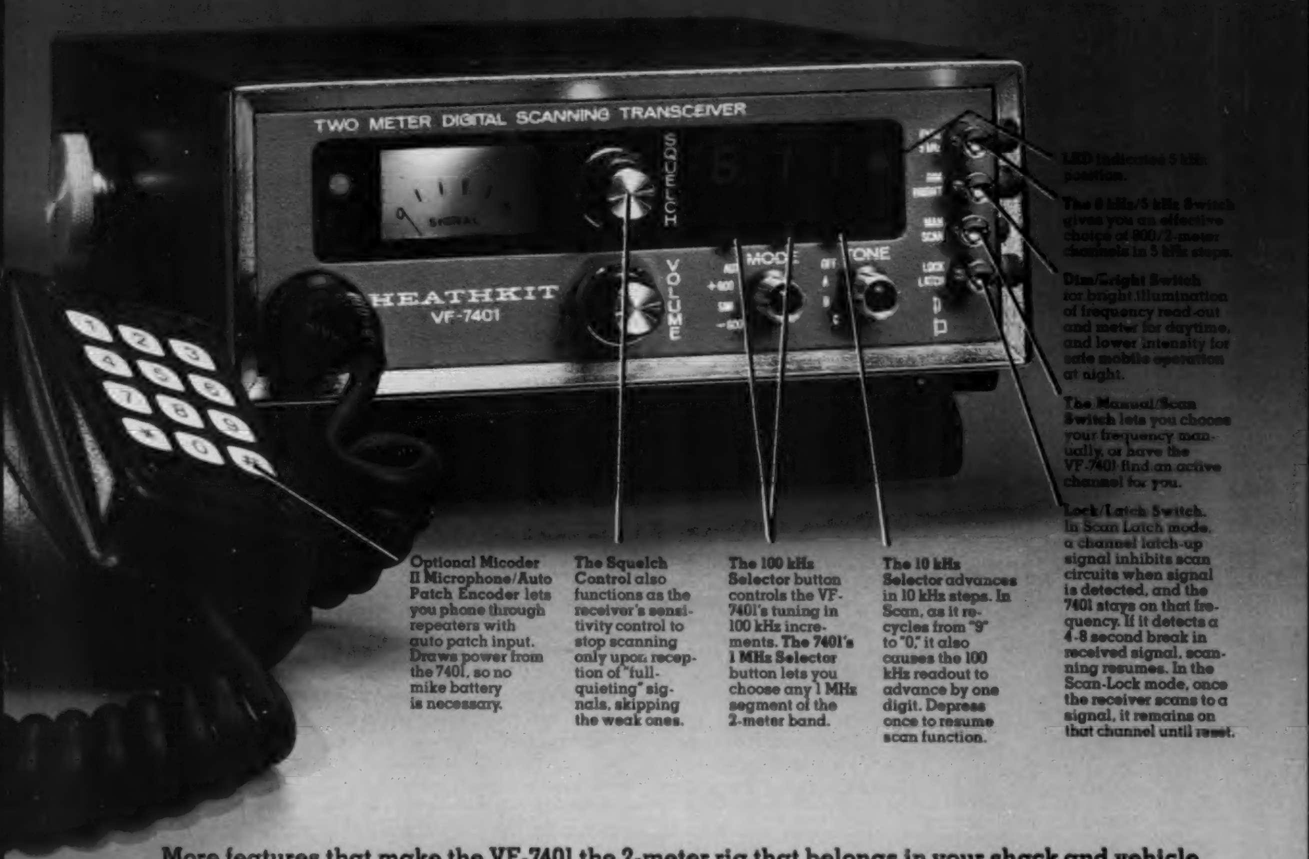
Henry Radio

Prices subject to change without notice.

Announcing the Heathkit VF-7401 2-meter FM Digital Scanning Transceiver



LED indicates 5 kHz position.

The 0 kHz/5 kHz Switch gives you an effective choice of 800/2-meter channels in 5 kHz steps.

Dim/Bright Switch for bright illumination of frequency read-out and meter for daytime, and lower intensity for safe mobile operation at night.

The Manual/Scan Switch lets you choose your frequency manually, or have the VF-7401 find an active channel for you.

Lock/Latch Switch. In Scan Latch mode, a channel latch-up signal inhibits scan circuits when signal is detected, and the 7401 stays on that frequency. If it detects a 4-8 second break in received signal, scanning resumes. In the Scan-Lock mode, once the receiver scans to a signal, it remains on that channel until reset.

Optional Micoder II Microphone/Auto Patch Encoder lets you phone through repeaters with auto patch input. Draws power from the 7401, so no mike battery is necessary.

The Squelch Control also functions as the receiver's sensitivity control to stop scanning only upon reception of "full-quieting" signals, skipping the weak ones.

The 100 kHz Selector button controls the VF-7401's tuning in 100 kHz increments. **The 7401's 1 MHz Selector** button lets you choose any 1 MHz segment of the 2-meter band.

The 10 kHz Selector advances in 10 kHz steps. In Scan, as it recycles from "9" to "0," it also causes the 100 kHz readout to advance by one digit. Depress once to resume scan function.

More features that make the VF-7401 the 2-meter rig that belongs in your shack and vehicle

No more searching through repeater guides while mobiling in unfamiliar territory – your new Heathkit VF-7401 will find the active channels for you. It will even alert you to band openings. You're going to enjoy building your VF-7401... and you're going to love using it. The VF-7401, the ultimate 2-meter rig...from the more than 200 Hams at Heath.

- Adjustable, 15-watt (nominal), solid-state, narrow-band FM Transceiver. Fully synthesized digital circuitry provides full-band coverage without need for added crystals.
- All-new, state-of-the-art circuits provide the exciting, exclusive features of 1 MHz bandwidth scanning, and Scan Lock/Latch capability on 2-meters.
- A receiver hotter than Heath's HW-2036A features dual-gate MOSFET front-end to minimize overload and adjacent-channel interference.
- "Power-up" on a pre-programmed frequency of your own choice, such as your favorite repeater.
- Convenient detachable mike using 4-pin connector.
- Power to the Micoder II Microphone (if used) eliminates need for a battery.
- Sturdy SO-239 rear-panel antenna jack.
- Chassis-mounted power and external speaker plugs.
- Improved synthesizer, eliminating need for panel mounted sync lock light.
- Tuning for Power Amplifier and output power level adjustment is accessible without removing case.
- Capability of mobile or base operation (with Model VFA-7401-1 AC Power Supply – 13.8 V at 4A nominal, transmit).

SEND FOR FREE CATALOG

The new VF-7401 is featured in the latest Heathkit Catalog. For a free copy write: Heath Company, Dept.011-684, Benton Harbor, MI 49022. Or visit the nearest Heathkit Electronic Center in the U.S. or Canada where Heathkit products are displayed, sold and serviced. See the white pages of your phone book for location. In the U.S., Heathkit Electronic Centers are units of Veritechnology Electronics Corporation.

This device has not been approved by the Federal Communications Commission. This device is not, and may not be, offered for sale or lease, or sold or leased until the approval of the FCC has been obtained.

Heathkit®

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W2NSD/1
NEVER SAY DIE

editorial by Wayne Green

A HAM CAREER?

Why not? I chose that avenue for enjoying both my hobby and my life and I've had so much fun "working" that it almost makes me feel guilty. The brand new Swan rig just arrived and we naturally have to check it out on the air to see how it works. That's work? Well, it's a bit more difficult to sit down and write up the results so the readers will know more about the rig and have a valuable second opinion . . . particularly when the ham shack offers comparison operating with the Icom 701, the Yaesu 901, and other late model rigs.

Just look over the last few issues of *73 Magazine* as compared with *QST* and I think you'll see why we're looking for people to help us put out our magazines and books. For example, if you'll count the pages of articles in the May and June issues of the two magazines, you'll find that *73* has 250% more pages of articles! That's two and a half times as many . . . and that means it takes us a lot more work to get *73* ready for printing.

Sure, amateur radio is in the doldrums these days, but with a good crew here at *73*, I think we can do a lot to help the hobby get moving again. Obviously I can't do all that alone . . . it takes dedicated hams working to edit and prepare articles for publication, to edit books for publication, to keep in touch with the manufacturers and dealers for ad sales and product promotions, to keep after firms who are giving hams shoddy treatment, and to keep abreast of what is going on in amateur radio all over the world.

I can help amateur radio best, I suspect, if I'm able to get away and help bring hams into hamfests with my talks . . . if I'm able to get to Washington to talk with the FCC people . . . to talk with Congress (I am and have been a registered lobbyist for amateur radio for years) . . . and have the time to visit lesser-developed countries to push for the development of amateur radio clubs which will benefit those countries.

We're looking for hams who are enthusiastic enough about amateur radio to make it their life . . . and who will be able to help select the articles we are to run, work with authors to get special articles, sell ads, keep track of new products, help with circulation efforts, and handle the dozens of other tasks which it takes to put out an interesting and valuable monthly ham magazine.

By now it should be no secret that we hire only non-smokers, so the air is sparklingly clean in our offices. And despite our size (130 people in all at last count), things are remarkably unstructured. This is a problem for some people and a blessing for others. It allows growth in just about any direction. One of our top ad sales people started in the shipping room. The Assistant Publisher arrived with nothing particular in mind and was started out editing books . . . now he almost runs the place. Others have come, put in as little of their 40 hours a week as possible, and have gone nowhere.

After visiting much of the world and most of our country, I can honestly say that there is no place that I've visited which I would trade for this small secluded corner of New England. The climate is fantastic . . . a bit cooler than New York, with pure clear air always, too little snow in the winter, and not too hot in the summer. It is a state where vacations are the major industry . . . with vacationists just about all the year around. Peterborough is protected from this by being in a little valley of its own. Housing is a difficult problem in Peterborough itself, but the surrounding towns, which use Peterborough as a shopping center, offer bargain housing as compared to most areas of the country.

One other thing . . . when you work in the ham business, you soon get to understand much more about the political aspects of amateur radio. You learn things about the ARRL that few

NO TAXES!

Looking for a job? *73* is currently seeking applicants for one of its top staff positions. In addition to being a non-smoker, the qualified candidate will be a ham with an outstanding knowledge of electronics, an excellent command of the English language, and experience as a working journalist. We offer a competitive salary, fine fringe benefits, and excellent working conditions—as well as the opportunity to live and work in beautiful, tax-free New Hampshire. Interested parties should respond with resumes to: Director of Personnel, *73 Magazine*, Elm Street, Peterborough NH 03458.

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Hand-shack.

Synthesized, big LCD, 10 memories, scanning, DTMF

Touch-Tone®

TR-2400

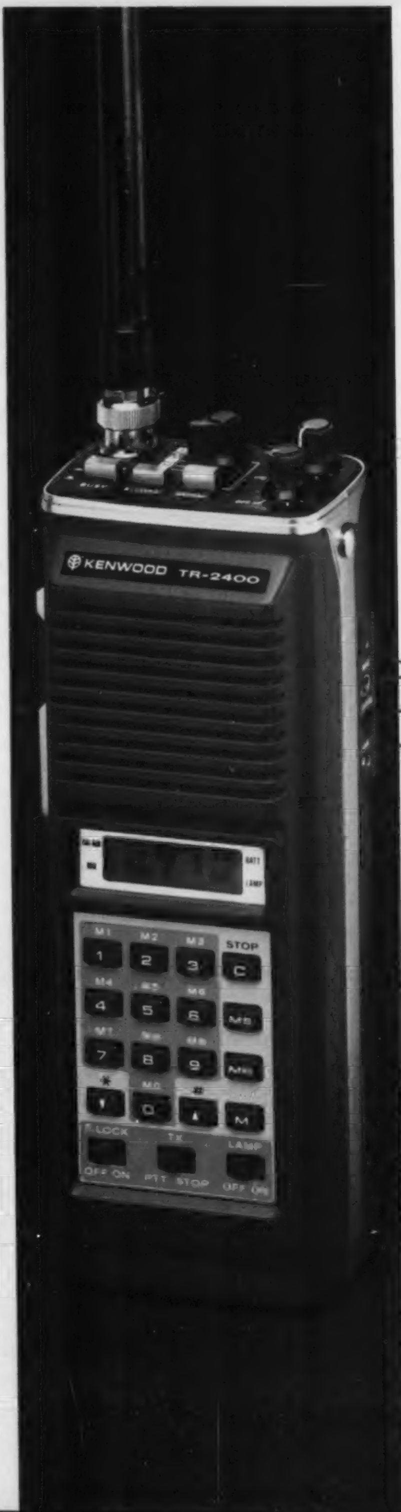
Put a ham shack in your hand. The TR-2400 is the ideal hand-held for 2 meters FM. It features a large LCD readout that can be read in direct sunlight or in the dark, 5-kHz-step PLL synthesized operation, 10-channel memory, scanning, and 16-button autopatch DTMF encoder.

TR-2400 FEATURES:

- **Large LCD digital readout**
  Readable in direct sunlight (better than LEDs). Readable in the dark (with lamp switch). Virtually no current drain (much less than LEDs) and display stays on. Rugged and dependable in hot or cold temperature ranges. Shows receive and transmit frequencies and memory channel.
- **5-kHz-step frequency selection**
  PLL synthesized keyboard channel selection system. No "5 up" switch needed. Selects from 144.000 to 147.995 MHz.
- **UP/DOWN manual scan**
  Single or fast continuous 5-kHz steps from 143.900 to 148.495 MHz for Amateur and MARS or CAP simplex or repeater operation.
- **10 memories**
  Retained with battery backup (only 0.8 mA). "M0" memory may be used to shift the transmit frequency any desired amount to operate on repeaters with nonstandard split frequencies.
- **Built-in autopatch DTMF (Touch-Tone®) encoder**
  Uses all 16 buttons of keyboard while transmitting.

CONVENIENT TOP CONTROLS
TX OFFSET
SQL
+
S
−
M
VOL
OPEN
BIN
REV
BUSY
S.TONE
NORM
OFF

- **Automatic memory scan**
  Checks all 10 memory channels. Programmable to lock automatically on either BUSY (signal present) or OPEN (no signal) channels.
- **Subtone switch**
  Activates subaudible tone encoder (not Kenwood-supplied).



- **Repeater or simplex operation**
  Convenient mode switch shifts transmit frequency +600 kHz or -600 kHz or to the frequency stored in "M0" memory.
- **Reverse operation**
  Nonlocking switch shifts receiver to transmit frequency and transmitter to receive frequency.
- **Extended operating time**
  With LCD and overall low-current circuit design. Only draws about 28 mA squelched receive and 500 mA transmit (at 1.5 W RF output), for longer operating time between charges.
- **Two lock switches**
  Prevent accidental frequency change and accidental transmission.
- **BNC antenna connector**
  Easy to connect external antenna.
- **LCD "arrow" indicators**
  Show "ON AIR," "MR" (memory recall), "BATT" (battery status), and "LAMP" switch on.
- **High-impact case and zinc die-cast frame**
  Extremely rugged with antenna counterpoise.
- **External PTT microphone and earphone connectors**
  Easily accessible on right side of transceiver.
- **Compact and lightweight**
  Only 2-13/16 inches wide, 7-9/16 inches high, and 1-7/8 inches deep. Weighs only 1.62 pounds (including antenna, battery, and hand strap).

STANDARD ACCESSORIES INCLUDED:

- Flexible rubberized antenna with BNC connector
- Heavy-duty (450-mAh) NiCd battery pack
- External-standby (PTT) plug
- AC charger
- Hand strap
- External-microphone plug
- Earphone

NOTE: *Price, specifications subject to change without notice and obligation.*

OPTIONAL ACCESSORIES:

- ST-1 base stand (shown) which provides 1.5-hour quick charge and automatic switch to trickle charge, floating charge (operate while charging), 4-pin connector for dynamic microphone, and SO-239 antenna connector
- BC-5 DC quick charger (1.5 to 2.0 hours)
- LH-1 deluxe leather case (top-grain cowhide)
- PB-24 extra battery pack with charger adapter
- BH-1 belt hook

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outside of their directors know. You learn who really are the bad guys and who are the good guys . . . and there are plenty of both.

If you're interested in making both amateur radio and publishing a career, drop me a line and tell me what you think you might be able to do for us . . . and what experience you've had which qualifies you.

What about our prospects? Well, with the ARRL admitting to serious losses and cutting down on their staff, with both *Ham Radio* and *Ham Radio Horizons* fading away rapidly, and with *CQ* uncertain at best, the field appears shaky. Despite the signs of disaster all around, *73* is doing very well . . . has more pages of ads than *QST* . . . and is growing in circulation. *73* is making money and is in healthy shape. I think, with some leadership from *73*, the hobby can get into a growth mode soon again.

There are some very exciting times coming up for amateur radio as we here at *73* push for amateur pioneering of new communications modes. These could well revolutionize the hobby as much as sideband did twenty years ago and repeaters did ten years ago. It's time for some new ideas and we have them. You can be a big part of this if you have the enthusiasm and the guts to make a big positive change in your life.

Salaries? They're adequate for the area and the responsibility undertaken. We don't have a need for inexperienced management in the higher brackets, so if you are in the over $20,000 range, you will have to have an incredible amount to offer. We much prefer to promote from within into the middle and higher management positions. One more thing . . . my job is available, if you can handle it.

ATTENTION, ENTREPRENEURS

If you've read much about nicad batteries, you know that while they are almost as remarkable an invention as Baggies, you also know that keeping them properly charged is almost impossible. Reading articles on nicads confuses matters more often than clarifies them.

My latest HT had nicad charging instructions with it. It seems that nicads have a memory and that to get them to keep their full capacity one must discharge them fully before charging. If one does not go through this routine, then the confounded battery will remember where you put it on recharge last time and stop working there. None of my chargers understand this problem.

After grumbling about this situation for a while, the light finally dawned. Why not make a smart nicad charger? Why not make a charger which will first discharge the nicads and then, when it senses that they are prostrate, slap in the approved charge rate to build them up so that I will get maximum life and pep out of them?

Shucks, it could even be made a little smarter than that. If there was a built-in tray for a group of AA nicads, the charger could be made to check each nicad separately and give it personal treatment. Now and then some of us (me) chance to leave a piece of equipment turned on . . . or it gets turned on by itself in a bag (my old Wilson HTs with the toggle switch on top were fantastic for that) . . . anyway, now and then a cell will go negative and need to be shorted out until it is totally dead . . . then it should be socked with a hard charge. A smart charger could do that.

Okay, there is your key to a million dollars. All you have to do is put the idea into a working model, go into production, and get it into every discount store in the country. And, hey, put me down for 2% of the gross for the idea. If you don't pony up with the royalty, I will stop giving you ideas and make things myself.

NARA?

The first I heard of the National Amateur Radio Alliance was when a chap who had been to Dayton talked with me at Wiesbaden in Germany during the hamfest there in early May. I'd been traveling in Europe since mid-April and apparently was a little out of touch.

He said that ten hams had put up $15,000 each to form a new national organization and that they were actively soliciting membership at Dayton. I was immediately suspicious. How could ten hams with that kind of money get together and decide to start something without getting in touch with me about it? And if they were doing it without any help or advice from me or *73 Magazine*, why? It wouldn't seem like an aboveboard operation if they were keeping it that secret.

Upon my return, I checked with our crew who had been at Dayton. They hadn't seen or heard of any NARA out there. Hmmm, more curious. There just aren't a lot of hams who could put up $15,000, and I've long been in touch with most of the hams who have taken any serious interest in the improvement of amateur radio. What was going on?

A letter, undated, was waiting for me . . . from a most interesting chap. He mentioned that he was one of the those involved in NARA, but he mentioned no one else. Since this chap was responsible for one of the bigger rip-offs in ham history, and the last I heard had screwed many amateurs . . . particularly in other countries . . . out of thousands of dollars, I started to worry. That scandal involved *QST* ads and happened several years ago. The chap now has a new location and a new call.

If NARA is legitimate, I'll be one of the first to want to try to help with what they are doing, but the secrecy, the emergence of one of the most rotten apples of hamdom with a deep involvement . . . I must ask for caution and suggest that we hear more before spending money with NARA.

THE MELTING POT

An idea has been percolating up through the withered remains of my grey matter. I'll try to put it into receivable shape.

It started a few weeks ago while I was in Europe. I was talking with a Frenchman and he was expressing some concern that microcomputers might bring damage to French culture. Hmmm. I mulled that one over, looking for a handle on it.

After a bit of mental gymnastics, I had the pieces in place. This chap was expressing concern, in his way, over the ubiquitous BASIC language, built into the ROM memory of microcomputers . . . in English. Sure, we can write the print statements in French . . . or German, etc., but the French *have* to come to grips with English if they are going to write any BASIC programs.

The French are not neutral about languages . . . nor about much else, for that matter. There really is only one language of significance for them and there

Continued on page 154

IC-720

The New Standard in Ham Radio

You're looking at the next generation in ham radio design. The ICOM IC-720 has standard features offered elsewhere as options . . . or not offered at all:

Transmit on all 9 HF bands . . .

Receive from .1 to 30 MHZ . . . with just a push of a button.

Dual built-in VFO's.

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There isn't enough room to list all of the specifications and features of this exceptional radio. So, please visit an authorized ICOM dealer or write to the address below for additional information.

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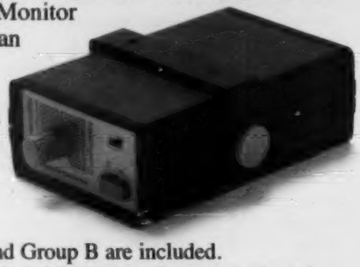
Communications Specialists TE-64
OFF

Food for thought.

Our new Universal Tone Encoder lends it's versatility to all tastes. The menu includes all CTCSS, as well as Burst Tones, Touch Tones, and Test Tones. No counter or test equipment required to set frequency-just dial it in. While traveling, use it on your Amateur transceiver to access tone operated systems, or in your service van to check out your customers repeaters; also, as a piece of test equipment to modulate your Service Monitor or signal generator. It can even operate off an internal nine volt battery, and is available for one day delivery, backed by our one year warranty.



- All tones in Group A and Group B are included.
- Output level flat to within 1.5db over entire range selected.
- Separate level adjust pots and output connections for each tone Group.
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- Powered by 6-30vdc, unregulated at 8 ma.
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SELF-IMPOSED EXILE DEPARTMENT

Recently, after a long telephone discussion with Wayne, I took a break from most two-meter FM operation in Los Angeles. Why? There were a number of reasons, but the most important one was that I wanted to be sure that I was keeping objectivity in my reporting. It's no secret that when a person is emotionally involved in a given situation, he or she can gain a distorted view. For a writer/reporter this can be disastrous, and for this reason I packed away all equipment capable of hearing two-meter FM operation in the Los Angeles metro area. I spent a lot of time SWLing the outlying areas of this community and listening to FM operation in those areas. I did this both from my home and from the facilities of a mountaintop remote-base system.

During this same period, I did quite a bit of traveling to other cities. I had a chance to listen to the two-meter band in cities far removed from Los Angeles to see if they fare any better than we do. I also started to SWL the high-frequency bands—again, to gain some insight into the problem of malicious interference. The results of this combination of self-imposed exile and ongoing research surprised me.

First, and most important, I have learned that the problem of malicious interference is not limited to any one band or geographic area. Listening on the low bands was a real eye-opener. Forgetting the ongoing WESTCARS situation, which is a problem unto itself, I heard all sorts of regulatory violations. DXpeditions operating outside the US phone bands were being called on their frequency by stateside amateurs—or just being "commented on top of"—and stateside hams were getting a reply from other stateside amateurs . . . or getting "chewed out" by same.

Noel McKeown WB8QQC, General Chairman, had his hands full with more than the Hamvention.

Then there are those who feel they own a given frequency, and pity the poor soul who, by choice or chance, winds up on that special spot. As the CBers would say, "The hammer comes down." (The CB crowd also has a name for an operator who thinks he owns a frequency; such individuals are "channel hogs.")

Shall I go on? If there is any comfort in all this, maybe it's in knowing now that repeaters are not the only ones suffering. Some comfort!

For those of you who think that Los Angeles is the repeater jamming capital of the nation, I can tell you that we are not alone. In my travels, I have spoken with many amateurs and have learned that the problems of LA are the problems of other cities as well. Every area seems to have its share of kooks, and in general their act is the same.

Most of those I spoke with seem to agree on one point. The only way to beat a jammer is to beat him at his own game. If you look at a jammer as being someone demanding attention and recognition as a way of fulfilling ego needs, then denying the jammer such attention can be a formidable weapon. Ignore him!

Recently, the ARRL formed an Ad Hoc Committee on Malicious Interference. This was brought about at the urging of Los Angeles attorney Joseph Merdler N6AHU and ARRL Southwestern Division director Jay Holladay W6EJJ. Both men are vitally concerned with the future of the amateur service, and the committee actually was formed through a motion placed before the board of directors by Jay. How effective this committee will be remains to be seen. It's interesting to note that even though Joe is considered this nation's leading authority on both the causes of this problem and the methods to obtain help in combating it, he has yet to be asked to take official part in the committee's operation, even as an advisor. The ways of Newington are strange at times. Nonetheless, that committee is looking for input on the problem, so there is a definite avenue through which you can vent your frustrations.

If you do write, and I strongly advise that you do, be sure to include suggestions as to how you feel this problem can be combated effectively. Complaining about the problem is fine, but that privilege brings with it a responsibility to offer constructive advice as well. Also, if you do write, send a copy of your letter to Joe at PO Box 842, Northridge CA 91328; I know he will be interested in your views.

FLIGHT 72 DEPARTMENT: IS GETTING THERE REALLY HALF THE FUN?

A few months ago I told you about a "magic" nostalgia-filled trip via AMTRAK to Las Vegas; now I am going to describe an airborne nightmare.

I really enjoy traveling by air . . . usually. Once in a while, though, things happen that can really set you to wondering. The very early hours of Saturday, May 24th, brought me one of those experiences that one wants to go through only once.

The Amateur Radio Computer Hobbyist Convention was being held in St. Louis, Missouri. Both Joe N6AHU and I were scheduled to speak, so we decided to travel together. Also in our entourage was Bill Orenstein KH6IAF, Westlink's Production Coordinator. We were to depart from Los Angeles International Airport (LAX) at 12:45 am on TWA Flight 72 nonstop, a 3½-hour trip.

We arrived at LAX well before flight time, checked in, and decided to grab a midnight bite at the coffee shop since we had about 1½ hours to kill. Little did we know how smart a move this was. Thirty minutes before the flight, we arrived at the gate figuring that the plane would be ready for boarding. No way. As it turned out, it was well after 1:00 am before we were airborne.

The aircraft was a Lockheed L-1011, usually one of the most luxurious planes in the sky. Not this one. In fact, after a while we began to feel as if we were part of an episode of the old TV program "Twilight Zone." For instance, while our overhead reading lights and air conditioner outlets worked fine on the ground, at altitude they stopped altogether, except for Joe's light, which kept blinking on and off at unscheduled intervals regardless of the position of the on-off switch.

Then there was the food.

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The Spectrum Communications booth had to be cleared of a complimenting crowd before this shot could be taken.

DARA (Dayton Amateur Radio Association) thought of everything, including this specially-equipped mobile talk-in van.

What a gourmet treat! About 30 minutes after takeoff, the attendants distributed to each passenger a small cellophane wrapped box which contained two small breadsticks, two crackers, one small bag of pretzels, one granola bar, a small plastic container of cheese spread, a cheese-spreading utility tool (wood), one napkin, and airline promotional material.

That was it! Except for some beverages, that was the extent of the food service. None of the cute little miniature sandwiches such as were served on a United night coach flight four weeks earlier when we went to the Dayton Hamvention. No . . . just a goodies box that I could have filled from an airport vending machine. Now you understand why we were lucky to have grabbed a bite before getting on the plane. For those of you who find the foregoing hard to believe, Bill KH6IAF still has his box unopened. He's saving it as a souvenir!

Along about sunrise, the Captain got on the intercom to tell us that St. Louis was fogged in and that we would be sitting at 33,000 feet for a while in hope that the fog would clear. About 45 minutes later, he made an announcement that we would be going to Kansas City to await the reopening of the St. Louis airport. By this time, Bill and I were kind of hungry, and we figured any place with food would be welcome. So, 30 minutes later we landed in Kansas City, only to learn that while we could deplane, we could not leave the gate area. Why? No security people to recheck us through those crazy machines. Now, I grant you that in this day and age airline security is important, but this was just totally absurd! What were they afraid of? That I might smuggle a prune Danish on board?

We were on the ground in Kansas City about an hour and 45 minutes. Finally, it was announced that we would depart for St. Louis, and a few minutes later, I think we did. I say "think" because by this time I was so tired that I was out like a light as soon as I hit the seat. I remember neither the takeoff nor the landing. My plan had been to get to the hotel by 7:00 or 7:30 am and sleep till noon, but it was noon by the time we got our bags and reached the Sheraton.

Oh, yes, getting our bags . . . that was a trip in itself. The St. Louis airport has a unique baggage handling and claim system. Instead of each carrier having its own claim area, St. Louis uses a central baggage claim area, which is currently under reconstruction. Over a highly distorted public address system, they announce which baggage will be on which carousel, and, if you are lucky, you will get the message the third or fourth time it's announced. In our case, since our flight was a few hours late (as were many others), there was a short delay in obtaining our bags. They announced it would be 10 minutes. Then another 10 minutes, then another 10 minutes, and so on. About an hour later, our luggage followed us off the aircraft and met us in this baggage-pickup parlor. In all, a flight that was supposed to be 3½ hours was twice that. Creature comfort was nil and I will be writing TWA a strong letter about this one.

In closing this segment, just a note about the ARCH Convention: It was sensational.

DAYTON IN PICTURES DEPARTMENT

Last month, I told you about the personal side of my trip to Dayton's annual Hamvention and promised you a picture story this month.

Two of the nicest people I have ever met are Noel and Marilyn McKeown. They are two "together" people, and both devoted quite a bit of time to the Hamvention. Noel served as the General Chairman, and Marilyn was involved in a myriad of things. It was also a first for their 8-month-old daughter—her first Hamvention. As you can see from the photo, already she is very much involved.

The photo of the Spectrum Communications booth was not an easy shot to get. Spectrum's high-quality line of amateur and commercial repeaters drew large crowds, and I actually had to ask those in front to step away for a moment so that I could photograph it.

Our final photo was taken inside the DARA communications "mobile home." This is an installation you must see to believe. It's capable of operation on virtually any band in any mode, and can go just about anyplace it's needed. That's Greg WB8AVK doing his stint on the "hamvention talk-in station." If you get to the Hamvention next year, look for a silver mobile home with the DARA emblem on its side. It will be parked alongside the building adjoining the flea-market area.

Hamvention '80 was a true "blast." If you were among the 26,000 people who attended, then you know this firsthand. If you weren't, then I can suggest only that you try to get to Hamvention '81. If '80 was any indication of what is to come, then you are in for a treat.

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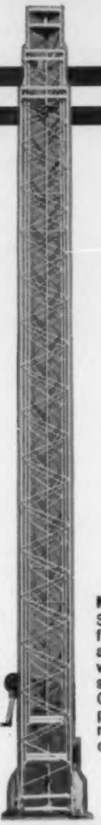

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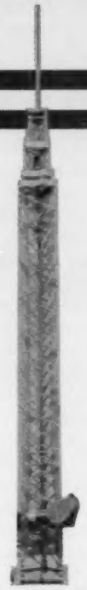

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DX

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LISTS

No, not the kind where you sit on a frequency for days waiting your turn to call a station you don't even know you are waiting for. Who could get along these days without lists: groceries, resolutions, errands. Mr. Nixon had his Enemies List and the ARRL has its Entities List. Like it or not, other DXing awards notwithstanding, our DX corner of the hobby revolves around the ARRL DXCC Countries List, CD-216 in Leaguese. Let's look at it.

DXCC is a club, the DX Century Club. One hundred countries and you're in. No blackballing, no dues, no rituals—just a hundred QSL cards from different places listed on CD-216 and the DXing game begins in earnest. The second hundred are normally easier than the first, while the third hundred becomes real sport. After three hundred, the air gets pretty thin. DXCC has been sponsored by the ARRL since the 1930s. It was "started over" following WW II, on November 15, 1945, to be exact. In the succeeding three decades, DXCC has convoluted almost to the point of seeming alive at times.

But you know all this. There *are* other awards to be had while chasing DX, some sponsored by Americans and many more by other countries. Just like DXing itself, the awards are all political in nature and thus controversial. *73 Magazine* sponsors the "DX Country Club Award" for working 73 (or more) countries from *its* list during any calendar year. The *73* list has all the DXCC entities plus additional things like the African "homelands" and many spots which have been deleted from the DXCC list.

CQ Magazine has its "CQ DX Award," which is nearly identical to DXCC except they count *current* entities only. And not too long ago, *Worldradio* newspaper initiated a "Worked 100 Nations Award," which is summed up by their first rule: "W-100N virtually eliminates the need to work geographic areas heard only during DXpeditions. Almost all national entities have amateur stations consistently active on the air." Wishful thinking there, but they *have* knocked off the uninhabited rocks and reefs.

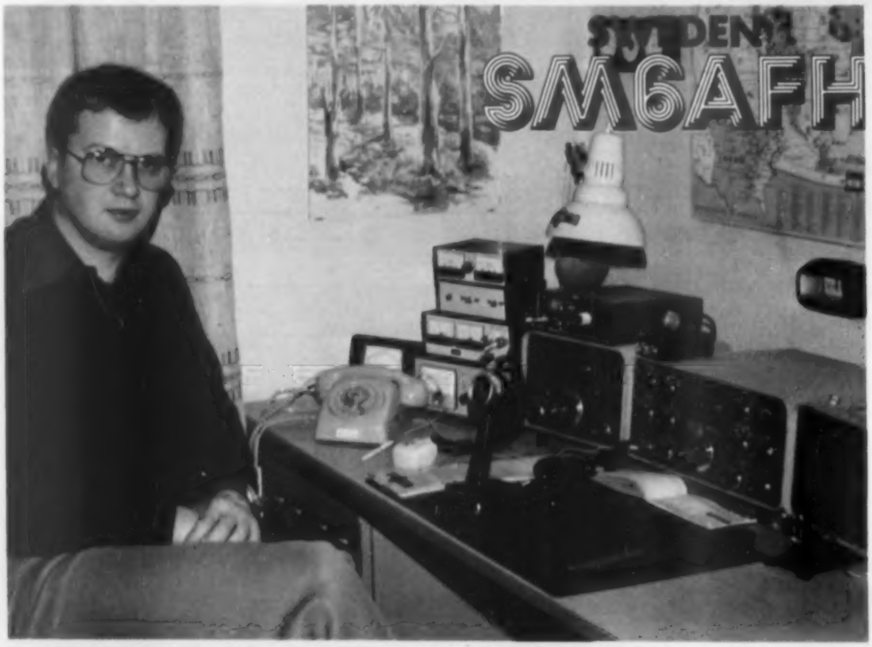
So by confirming a hundred countries or entities or rocks and reefs or buildings, you can probably use the hundred QSLs to qualify for not one, but actually four, handsome pieces of wallpaper. And if you're multimode, you should be able to paper an entire small room. DXCC isn't the only game in town, you see.

But DXCC *is* the main attraction. It has run a long time and generally has been administered with care and consistency. In the vernacular, we would call the other awards "spin-offs" of DXCC, tailored to meet other needs and wants of DXers. Now, if DXCC hasn't been sufficient for some, will it be able to adapt to the 1980s? (See this column last month.) The Volkswagen Beetle was marketable for forty years as updating matched safety regulations, advancements in automotive art, and changing consumer tastes, but finally the end came. Will DXCC change with the times, will it be replaced by something all new from ARRL, or will one of the spin-offs overtake DXCC? Let's consider some of the angles, keeping in mind that DXing would probably be very different from what we know it had DXCC never existed.

DXCC is an "operating achievement award," created in the 1930s to satisfy amateurs' competitive urge to excel. The challenge is different for all of us, with working the first hundred using two Watts tantamount to working them all with high power. For many, the real challenge comes above 300 countries, when the ones needed can be counted on the fingers and where patience and staying power count most. Between, say, 200 and 300, operating skill and staying informed make the difference. For some, the DXCC Honor Roll does not and will not hold the magnetism it has held for those of us who have spent decades approaching it. You must be able to do more than get on lists or check into "nets" to make the Honor Roll; expeditions as recently as the past month proved that and will continue to do so. Thus, those who do not develop operating prowess can forget the Honor Roll, but they probably do not have the necessary achievement orientation to make it anyway.

Until just a few years ago, if a US amateur moved over 175 miles, he was forced to start his DXCCing over from zero (unless he remained in the same call area). It was the mid-1970s before the ARRL recognized that people move and that working DXCC entities is more dependent on the operator and the availability of stations at the other end then on the operator's being in Iowa instead of Pennsylvania. "Rule 9" was then changed to state that contacts must be made from the same DXCC country.

Another problem which haunts serious DXers is the spectre of operating a DXpedition from an extremely rare entity when one does not have credit for that entity himself. In the past, it was not unusual to have a friend operate one's station in these cases; now that friend can (and often does) just sign the expeditioner's call from the friend's station to "put him in the log." Naturally, a moral question arises here which could be handled by merely rewriting DXCC rules to state that an expeditioner will receive DXCC credit for the rare entity from which he operates. Sound crazy? Well, the DX Advisory Committee of the ARRL thought so last year, when they voted down the proposition. But DXCC is just a game in which the greatest award is a plaque for "Number One of the Honor Roll," and for most of us it is



Tom Schell SM6AFH has a QSL worth swapping for. He's an active DXer with DXCC, WAS, and WAZ.

Summer

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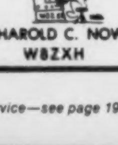

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simply self-satisfaction and peer recognition. If we worked a new one to elevate us to the Honor Roll and were asked if the operator who risked life and limb to put it on the air should get credit himself, we'd reply "yes" in an instant. The Honor Roll could thereby come to represent not only achievement in sitting at home, ear glued to speaker, waiting for new ones, but also for being on the other end helping the stay-at-homes. It would turn out to be, for some, a recognition of both facets of DXing. Or don't you like apple pie, either?

Possibly the greatest mistake ever made in DXCC was recognizing phone as a distinct mode to be credited and awarded separately. For years and years, the two awards available were Mixed and Phone, because it was initially more difficult to work DX on phone due to lack of stations, weaker signals, etc. Offering a phone award may have encouraged operation on that mode for the first year or two, but it did little else. Then when things came full circle, as they tend to do, many forgot CW and working DX became easier on phone than on code, so the League bent under the pressure from the die-hards and instituted, in 1976, a CW DXCC. But it does not even require two-way! All you have to do is find the station you want, work him on phone, then send your callsign to him on CW; he comes back on phone to tell you you are "five nine nine," and, presto! another CW DXCC credit. The irony of this system is that the DX station does not even have to be able to copy the code.

There's more. The past few years have finally seen DXCC awarded for RTTY, 160 meters, and OSCAR, but there are no endorsements at levels after 100 countries (entities). SSTV and FM (possible on 10 meters) have not made the grade yet. With the DXCC operation at Headquarters always behind these days, why not simplify things by issuing endorsements only in the Mixed category, and just the basic club membership of 100 on all other modes? That wouldn't be as far-fetched as the League's trial balloon a year ago of starting the *entire* DXCC program over at zero for everyone. Oh, sure, those on the Phone and CW Honor Rolls would find the first solution repugnant (not to mention the second!), but they could be accommodated by having an all-time, final Honor Roll for the first-wave DXCC. A similar situation has come up in the contest program, where wholesale changes in contest times and point structures have altered scores to the point where comparison to past records is meaningless. In the case of a contest like the November Sweepstakes, which is as old as DXCC, the argument about "tradition" seems to have not held much weight at Headquarters.

Larry Smith N1AAX along with Chris Emery K1RIF/VP2MFI operated VP2MFJ in April from the shack of VP2MF on the island of Montserrat. They made almost 2,000 contacts in about 32 hours. Photo by K1RIF.

A note: The latest blow to DXCC tradition came recently. Know those little cellophane stickers you endorse your DXCC certificate with (110, 120, 130)? Well, they're being phased out. We got stickers 260 through 290 the other day, and one was an oddball, opaque white instead of see-through cellophane. A guess would be that since the cellophane stickers were notorious for not adhering to the DXCC lapel pin, the decision was made to switch to a stronger glue sticker for both pin and certificate, rather than provide two different kinds of stickers (an added cost). But when you take your DXCC certificate (the certificate you've been adding to for years and years) out of the frame to add the latest endorsements and put that oddball sticker on, it's enough to make you cry. Start over with a brand-new certificate and all new matching stickers? And throw away the original from the 50s or 60s? Not a chance!

ON THE BANDS

August. Is it the pits of HF DXing? Well, July and September have some support as being the best time to take the antennas down for refurbishing, too. All three months are nothing to compare to autumn and spring conditions. At least when it's August, October, probably the best overall HF month of the year, is only weeks away. August is a good time to clean up those states you need for five-band WAS on 10-meter sporadic-E and for weeding your garden. The All Asia CW Contest and the Worked All Europe Contest are August attractions and can be very interesting summertime activities; they can also witness horrible propagation. It's chancy.

May expeditions were plentiful in 1980, although the rarity was not up to the April show of TZ4AQS, Mali, K6LPL/Johnston, and Glorioso by FR0ACB and FR0ACC/G. Frank Turek, who operated ZA2RPS in 1971, operated in May from Madeira as DL7FT/CT3, using an Atlas 210X and TH3 Jr. beam. Frank spent much of his time on the air quashing rumors that he is going to Albania again soon. There is some hope along those lines, but not much.

A Dutch club, the Noviomagun DX Group, vacationed in Luxembourg in mid-May, eight of them signing "portable LX." QSL all of them to PA0KHS, Smaragdstratt 53, 6534WN Nijmegan, the Netherlands.

W5HF and K5GOE operated at the British Virgin Islands as VP2VEZ and VP2VEN respectively, both trying to complete DXCC with their VP2 callsigns.

Charles Jackson SV0AA put Crete on early in May, but his next stop at Rhodes (Dodecanese) was cancelled. His all-CW SV0AA/5 operating included regularly-scheduled forays into the US novice bands. QSL Box 722R, APO NY 09223.

Jerry Harley WA2TTI operated from Greenland the second week of May and was back again in June. His radio time is sandwiched between Air Force duties.

4Z4TT and another unidentified operator came on from the Tokelau Islands on May 10, operating ZM7AA for over a week but in a sporadic manner. Many Europeans went empty-handed in trying to work this one. There was no advance warning of the operation, either. Many *were* worked, however, and QSLs go to PO Box 22-572 for SSB and PO Box 22-800 for CW contacts.

During May, Eric Sjolund SM0AGD operated first from Swaziland as SM0AGD/3D6, followed by Botswana as A22GD, and then Rwanda as 9X5LE (an established station there). Most-

Continued on page 152

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RTTY Loop

Marc I. Leavey, M.D. WA3AJR
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Last month I began to examine commercial RTTY equipment, using first-hand information. Unfortunately, the particular piece of gear I was examining for this month's column developed a "fatal" malfunction. Rather than write about its failure, I have elected to return it to the manufacturer and delay a full review until later. It is my current impression that the particular review unit I received had been through the mill and that its faults were not representative of the line.

So, let's catch up on some reader input. Along the lines of receiving equipment, many of you are asking questions about the various "computerized" RTTY schemes. Tom Altman WA5JVH of Midland, Texas, writes, "Do you have any information on the Macrotronics M800 and M80 RTTY/CW interface?" Tom owns a Kenwood TS-180S and a Level II TRS-80 and would like to merge these two on RTTY. In a similar vein, Jerry Brantley N5ADJ of Crossett, Arkansas, has been bitten by the RTTY bug and has an Apple II in the shack along with his ham gear. Jerry outlined his choices as "1. Macrotronics—cheapest way; a. needs outside TU to work well; b. RFI? 2. Robot Model 800—a. new product, how reliable? b. How good is the built-in TU? 3. HAL—costs most."

Now, these are not easy questions to answer. My information indicates that the Macrotronics units themselves, for example, are not overly rf sensitive. However, the TRS-80, Apple II, or almost any other popular microcomputer may cause problems if operated in a typical amateur radio station. Call it a mixed marriage, if you will, between rf and digital electronics. The computers generate a good deal of hash, which may interfere with a broad band of frequencies on a receiver close by. The "bus-oriented" systems, especially S-100 ones, are notorious for putting out all kinds of radiation from signals traveling down the bus paths. My SWTPC 6800, for example, puts out birdies and whistles, which represent not only the system clock, but other assorted bus signals doing their own thing. Now, properly timed, this is great for playing the William Tell Overture on a nearby AM radio, but it can wreak havoc on RTTY signals. This problem is minimized both by shielding and through the use of a non-bus-oriented system, such as the TRS-80. Further, most computers do not respond nicely to rf floating around the shack and will either halt, crash, or make all kinds of messy errors. Nevertheless, operation of most systems is possible if you keep rf in the shack to a minimum and shield the computer to keep signals where they belong.

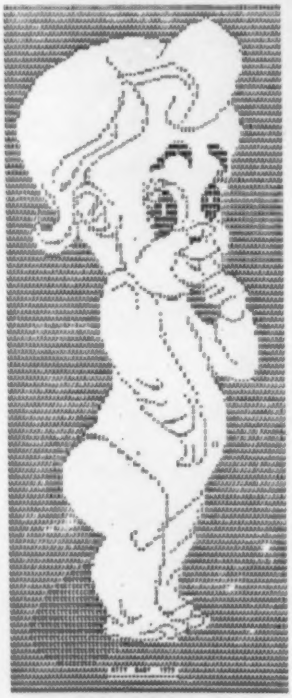
You don't have to go the commercial route, however, to put a microcomputer on RTTY. Programs have been published, here and in (shudder) other journals, which put most CPUs on RTTY. Although many of them require some minimal hardware for interfacing, the expense is certainly nominal, and this may well be the most cost-effective way for the ham with a computer to get on RTTY.

Now, many of these problems are solved through use of integrated units such as the HAL or Microlog series of RTTY terminals. Yes, they are expensive, but no more than the price of a computer, terminal, and interfacing. And, they do what they are designed to do very well. From information available to me, mostly on manufacturers' data sheets, any of the available "video RTTY" units should provide adequate service to the average ham. The various systems provide a variety of options and features which make operation on RTTY as it never was before! If you don't own, or are not contemplating owning, a microcomputer and you desire to enjoy silent RTTY, one of these is sure to satisfy you.

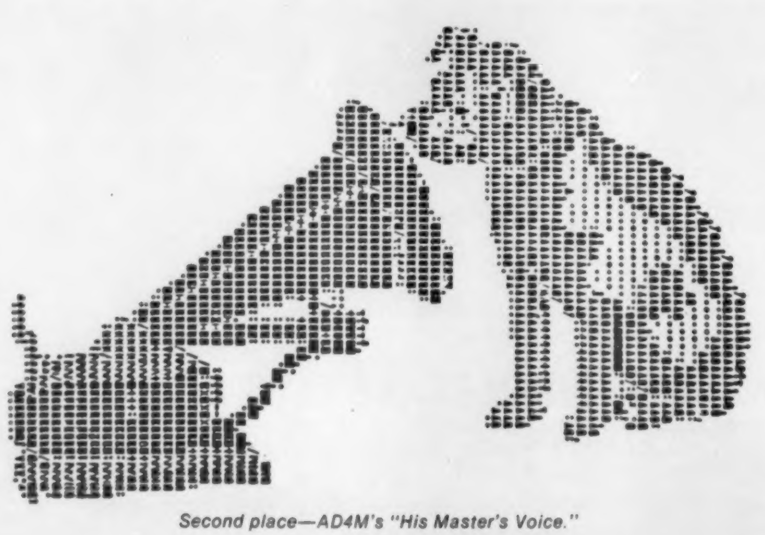
I am going to have to plead ignorance about the Robot system mentioned. I have no literature on it, nor can I recall any reviews. If any reader has experience with the Robot 800, he or she is invited to drop a line for future inclusion in this column.

Continuing along the lines of receiving, here is a tip passed along by Larry Clouse N0AAU of Gladstone, Missouri. One of Larry's requests is the passing along of useful modifications to commercial equipment that make our lives easier. Larry has the Flesher TR-128 speed converter and noted that the buffer will overflow if the speed control is turned down, so that data is coming in faster than it goes out. He suggests adding a diode from Terminal Board H going to pin 8 of IC1, a J-K flip-flop. He relates that, for example, when the buffer fills while transmitting at, say, 30 words per minute, this modification will open the speed control up to 60 until the buffer is almost empty. Then the flip will flop, and speed should resume at the previously set speed. Sounds interesting!

It seems like I end up mentioning this about once a year, but to respond to Robert Kerr KA3AAK, Rick Liftig WA1ISD, and the others who have written or called, *RTTY Journal* is, as far as I know, alive and being published regularly. Their address is: *RTTY Journal*, PO Box RY, Cardiff-by-the-Sea CA 92007. I know it seems like overkill, but when you write them, tell



First place—WB6SHU's "RTTY - Baby 1979."



Second place—AD4M's "His Master's Voice."

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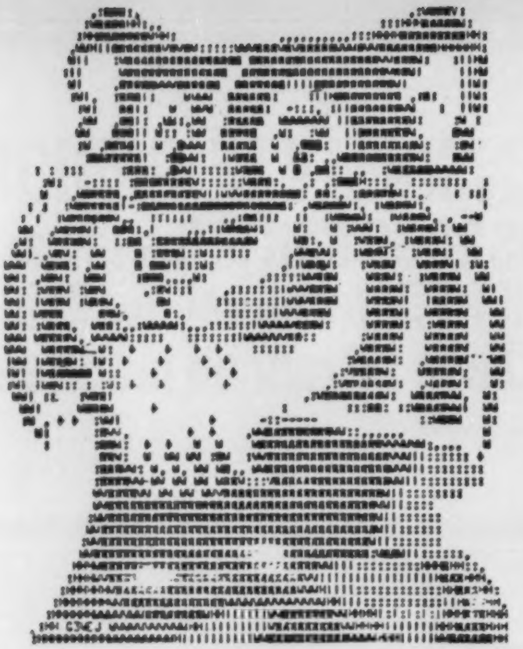
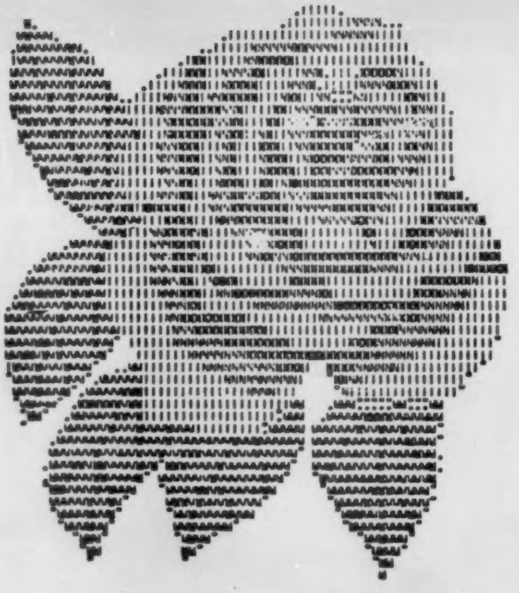


Third place—G3MEJ's "Old Gummy."



Honorable Mention—WB4VEU's "The Rose."

them you read about them here, in *73 Magazine*'s RTTY Loop. OK?

I always like to see new technology reach the air, and we are pleased to announce the arrival of the Maryland Mobileers Amateur Radio Club repeater, on 146.205/146.805 MHz, which runs AFSK in the Baltimore area. The data format is 170-Hz shift, 2125-Hz mark, and 45.45 baud Baudot. ASCII operation in the near future is anticipated.

Gonna close this month with a topic that I have not covered too much, but which interests most RTTY-philes: RTTY art. The Southern Counties Amateur Teleprinter Society (SCATS), of California vintage, completed judging for their 1979 Worldwide RTTY Art Contest. Ed Nally WB6HSU of Van Nuys, California, received first place in the contest for his entry, "RTTY Baby 1979." Second place went to Wendell Merk AD4M of Hollywood, Florida, who designed "His Master's Voice" after the old RCA logo. Paul Tew G3MEJ of Morden, Surrey, England, took third place for "Old Gummy." The fair sex took honorable mention as Sandi Clark WB4VEU of Hurt, Virginia, displayed "The Rose." These winning entries are reproduced here, although much reduced, and all look like winners to me.

Why not try your hand at entering the 1980 contest and win a large wood and brass plaque as WB6HSU did this year? Entries will be accepted after September 1, 1980, and SCATS will be publishing the rules in most ham publications. Who knows, maybe your picture will be printed here in RTTY Loop as one of next year's winners!

One final thought while we are on the subject of RTTY art. The situation reported in this column over the last several months involving Teleprinter Art, Ltd., is still quite active. I urge any hams who have had dealings with the firm in the last few years to forward a note to me, with details of your good or bad experience, at the above address. If you desire a reply, a self-addressed, stamped envelope is always appreciated.

Next month, a review of a book that guides you to new frequencies, more from the readership, and a lot more—in RTTY Loop.

Ham Help

I need a cathode ray tube for a Tektronix Model 549 memory scope. The tube is V859, Tektronix part number 154-0498-00 (description: T5490-202, CRT, standard phosphor). Scope is for hobby use—CRT need not be perfect but must be usable. Price must be very reasonable. Or does anyone know where I can get my old CRT repaired—filament open?

Curt Powell WB4WAA
Box 130, Powell Road
Rocky Mount NC 27801
(919)-446-3489

I need a schematic diagram and/or instruction manual for an RCA model 195(A) Voltohmyst VTVM. I will pay postage costs and/or copying costs or will borrow and return manual after copying myself. Thanks.

Stephen Olster K2MN
RD 1, Box 392B
W. Hurley NY 12491

I need information (operator's or repair manual) on a 2-to-5000-MHz dummy load, type AN/URM-58. The unit is listed as Federal Stock Number 6625-519-5488 and was manufactured by WacLine, Inc., Dayton OH, manufacturer's part number 22650. Adapters marked UG-1166/U and UG-1167/U are included. I would appreciate any help.

CPT Paul W. Morich, CAP
c/o Headquarters
New Jersey Wing
Civil Air Patrol
PO Box 16099
McGuire AFB NJ 08641

I am in need of full schematics for an FM two-way radio that was manufactured by DuMont Corporation. The only identifying name on the radio is "DUMONT FAIRCHILD TRANSICOM." Apparently there was a separate power supply which I do not have. Any help will be greatly appreciated.

Thomas A. Chambers
407 S. Williams St.
Denver CO 80209

I need a service manual or schematic for the Panasonic NV-3085 portable video tape recorder.

John S. Lee KA4EPR
17401 NW 20 Ave.
Miami FL 33055

I need a manual for a Hammarlund HQ-100 general coverage receiver. I will pay for an original or a copy.

Marvin Rosen KA3EUY
20 W. Madison St.
Baltimore MD 21201

ATR-6800

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R. TTY 0060                                        15:15:41 EST
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IT THEN AUTOMATICALLY RETURNED THE CALL WHICH GAVE ME
TIME TO GET TO THE RADIO.
SO JOHN, YOU'RE NOW TALKING TO CHARLIE (HUMAN) INSTEAD
OF THE ATR-6800 .... HI .. HI ....
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OK CHARLIE, GOOD SIGNAL DOWN HERE IN FLORIDA.
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MACHINE ...... IT MUST BE A MICROLOG (??) ..............
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LETTERS

HL9

Just thought I'd keep you up to date on the situation here in Korea. Since your visit to the Republic, there have been many changes in the HL9 environment. We now have an active radio club and club station (HL9TX).

Our club station is located on top of a small mountain inside the Yongsan military compound. The station is the fruit of much effort and is the only HL9 club station in the Republic of Korea. Inside the shack is a Collins KWM-2 which was rebuilt from scratch. The antenna is a Japanese C-218 tribander for 10, 15, and 40 meters. The antenna is located on the highest point on Yongsan, a water tank.

It is hoped that HL9TX will provide a new country for many stateside stations. I am pushing operations on 40 meters especially from this super location.

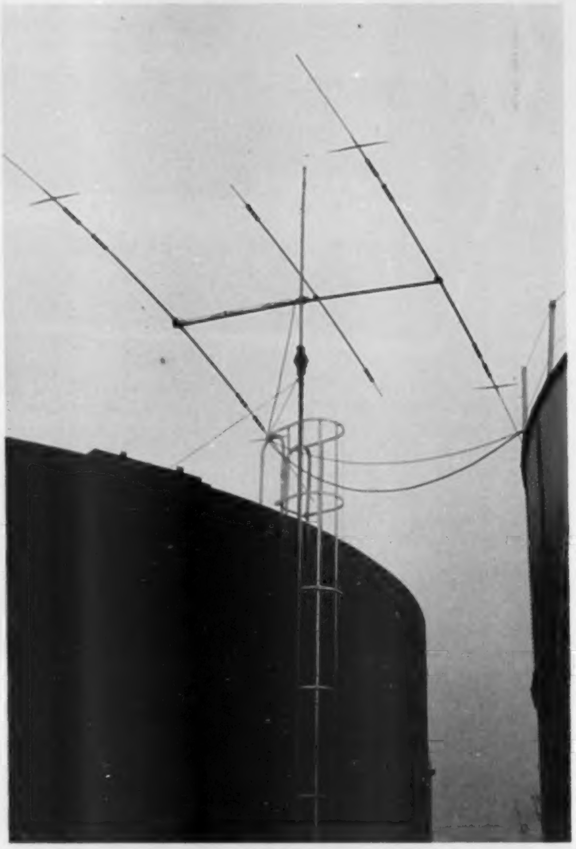
At this time, our proposed operating regulation is being studied by the Eighth Army staff. We are all anxiously waiting to see if it will be approved by the Korean government. If it is, it will allow licensing of Novice and Technician class stations for the first time in Korea. I have proposed several other changes which will prove very advantageous to the HL9 ham.

I will try to keep you informed as things come up. I hope you will disseminate as much information about HL9s as possible to the ham fraternity.

Thomas (Tom) L. Nickle HL9TN
APO San Francisco CA

You bet, Tom. You can also bet that the group of hams who will be with me in October on our tour of Asia will be looking forward to meeting you and the other HL/HM amateurs.—Wayne.

On the left is Thomas L. Nickle HL9TN, President of the American Amateur Radio Club of Korea; to the right is Gary M. Keller WB0ZEE.



The C-218 antenna system for 10, 15, and 40 meters.

LITTLE LIGHT?

Well, you really got carried away in the May issue of *73*. I subscribe to all of your periodicals, so I guess there'll be some repetition in *Kilobaud Microcomputing* and *80 Microcomputing*.

I generally agree with your opinions regarding the ARRL and the FCC. I would like to see a little less innuendo and a lot more fairly detailed facts printed regarding both. Your brush is usually much too broad to be really credible. Neither of those organizations is 100% bad.

Now for the important stuff. The US did not "conquer" any countries in WWII other than Japan and part of Germany; true, we did not set up any long-range controls there, but we really have little problem with the Federal Republic and our problems with Japan in regard to trade practices are of our own making. We could effectively counter Japan's predatory trade practices without imposing import tariffs or anything like that. We only have to set up some bureaucratic regulations on imports from Japan and assign the development and administration of them to any one of a number of existing, well-qualified agencies, e.g., HEW, OSHA, HUD, etc. Japanese imports would slow up in a hurry, if not entirely dry up. Then maybe the Japanese would try regarding trade as a two-way street for a change.

Vietnam. Sure the military only fought there, and, as in Korea, fought under political constraints which made success impossible. We had absolutely no business in either place, but the blame has to be put on Roosevelt first for Korea and on the Irish kid for dabbling in Vietnam with his personal toy, the Special Forces. Not to forget, of course, the father of "The Great Society" who put a half million troops in Vietnam along with the "no win" policy.

Yep! I'm in favor of a viable CIA, too. But how can we have such a thing when classified information no longer exists for all intents and purposes? How would you like to risk your life in a "secret" operation knowing that a whole passel of congressmen are privy to that operation? You might as well have an oversight committee composed of AP, UPI, and all the major networks.

We're in pretty good shape other than Central and South America, Africa, and Asia? You're not sure about France? I am. In the case of France, charity begins and ends at home, particularly after they get all wrapped around the axle again and cry out for us to rescue them once more. Not that sure about Mexico and Canada either? Canada just turned rather decisively back toward

Continued on page 159

A SWAN FOR EVERY NEED

Talk State of the art, Versatility, or Economy — SWAN'S famous "world's best" Engineering team has designed a complete line of Transceivers to suit your need.

Take a look at the three hottest new SSB Transceivers this year. They're all made in America and they're all from Swan. Whatever your dreams—from a compact fully synthesized mobile to a full-blown base station with dual PTO's—one of these will bring them to reality today. They're all solid state, all 235 Watts PEP and CW on all frequencies, and most of all they're affordable.

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100 MX

Preserve U.S. Economy – Buy American!

Most Versatile HF 160M-10M Transceiver in the World—ASTRO 102 BX

Dual PTO's, 235 Watts PEP & CW on all frequencies. IF Passband tuning, with LED position indicators and full break-in.

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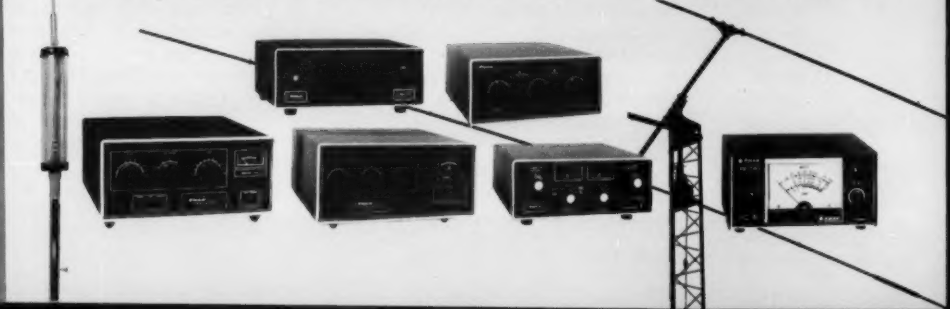


Contests

Robert Baker WB2GFE
15 Windsor Dr.
Atco NJ 08004

K0BM/9 KI

The Saint Charles Amateur Radio Club of St. Charles, Missouri, will be operating, for the 2nd time, a multi-rig station on historic Kaskaskia Island in the upcoming 18th Annual Illinois QSO Party. The dates will be from 1800Z August 2 to 2300Z August 3, 1980. The island dates back to the early 17th century when Joliet, the French explorer, and Father Marquette founded the church on the island. Kaskaskia Island houses the famed "Liberty Bell of the West." This is the only inhabited portion of Illinois that is on the Missouri side of the Mississippi River. The callsign will be K0BM/9 KI. A handsome 8 × 10 certificate will be available for all worked stations. Please send a 9 × 12 SASE for the certificate. Operating frequencies will be up 60 kHz on CW and up 25 kHz on the Novice bands. On SSB, the club plans to operate on 3975, 7275, 14275, 21375, and 28675. QSL to Mike McCrann WD0GSY, 25 Elm St., St. Peters, Missouri 63376; (314)-278-2578.

EUROPEAN DX CONTEST—CW

Starts: 0000 GMT
Saturday, August 9
Ends: 2400 GMT
Sunday, August 10

Sponsored by the Deutscher Amateur Radio Club (DARC). Only 36 hours of operation out of the 48-hour period are permitted for single-operator stations. The 12 hours of non-operation may be taken at once or in not more than three periods at any time during the contest. Operating classes include: single-operator, all band and multi-operator, single transmitter. Multi-operator, single-transmitter stations are only allowed to change bands one time within a 15-minute period, except for making a new multiplier. Use all amateur bands from 3.5 MHz through 28 MHz. A contest QSO can only be established between a non-European and a European station. Each station can be worked only once per band.

EXCHANGE:

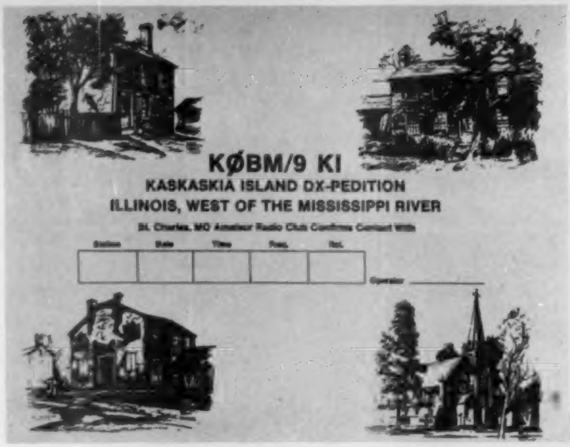
Exchange the usual six-digit serial number consisting of RST and progressive QSO numbers starting with 001.

SCORING:

Each QSO counts 1 point. Each confirmed QTC (given or received) counts 1 point. The multiplier for non-European stations is determined by the number of European countries worked on each band. Europeans will use the last ARRL countries list. In addition, each call area in the following countries will be considered a multiplier: JA, PY, VE, VO, VK, W/K, ZL, UA90. The multiplier on 3.5 MHz may be multiplied by 4, on 7 MHz by 3, and on 14 through 28 MHz by 2. The final score is the total QSO points plus QTC points multiplied by the sum total multipliers from all bands.

QTC TRAFFIC:

Additional point credit can be realized by making use of the QTC traffic feature. A QTC is a report of a confirmed QSO that has taken place earlier in the contest and later sent back to a European station. It can only be sent from a non-European station to a European station. The general idea is that after a number of European stations have been worked, a list of these stations can be reported back during a QSO with another station. An additional 1 point credit can be claimed for each station reported.


K0BM/9 KI
KASKASKIA ISLAND DX-PEDITION
ILLINOIS, WEST OF THE MISSISSIPPI RIVER
St. Charles, MO Amateur Radio Club Confirms Contact With
Station
Date
Time
Freq.
Rst.
Operator

A QTC contains the time, call, and QSO number of the station being reported, i.e., 1300/DA1AA/134. This means that at 1300 GMT you worked DA1AA and received number 134. A QSO can be reported only once and not back to the originating station. Only a maximum of 10 QTCs to a station is permitted. You may work the same station several times to complete this quota, but only the original contact has QSO point value. Keep a uniform list of QTCs sent. QTC 3/7 indicates that this is the 3rd series of QTCs sent and that 7 QSOs are reported. Europeans may keep the list of the received QTCs on a separate sheet if they clearly indicate the station who sent the QTCs.

AWARDS:

Certificates to the highest scorer in each classification in each country, reasonable score provided. Continental leaders will be honored with plaques. Certificates will also be given stations with at least half the score of the continental leader or with at least 250,000 points. The minimum requirements for a certificate or a trophy are 100 QSOs or 10,000 points.

ENTRIES:

Violation of the rules, unsportsmanlike conduct, or taking credit for excessive duplicate contacts will be deemed sufficient cause for disqualification. The decisions of the Contest Committee are final. It is suggested that the log sheets of the DARC or equivalent be used. Send a large SASE to get the wanted number of logs and summary sheets (40 QSOs or QTCs per sheet). SWLs apply the rules accordingly. Entries should be sent no later than September 15th. North American residents may send their ap-

Calendar

Aug 1-7	**SWOT QSO Party**
Aug 2-3	**ARRL UHF Contest**
Aug 2-3	**Illinois QSO Party**
Aug 9-10	**European DX Contest—CW**
Aug 16-18	**New Jersey QSO Party**
Aug 16-18	**Rhode Island QSO Party**
Aug 23-24	**All Asian DX Contest—CW**
Aug 31	**Worked All Britain Contest—VHF**
Sep 13-14	**European DX Contest—Phone**
Sep 13-14	**ARRL VHF Contest**
Sep 13-14	**Pennsylvania QSO Party**
Sep 13-14	**CAN-AM Contest—Phone**
Sep 13-15	**Washington State QSO Party**
Sep 14	**North American Sprint**
Sep 27	**DARC Corona 10-Meter RTTY Contest**
Sep 27-28	**Delta QSO Party**
Sep 27-28	**CAN-AM Contest—CW**
Sep 27-28	**EX-KZ5 Reunion**
Oct 4-5	**California QSO Party**
Oct 4-5	**ARRL Simulated Emergency Test**
Oct 11-12	**ARRL CD Party**
Nov 1-2	**ARRL Sweepstakes—CW**
Nov 8-9	**European DX Contest—RTTY**
Nov 8-9	**IPA Contest**
Nov 9	**International OK DX Contest**
Nov 15	**DARC Corona 10-Meter RTTY Contest**
Nov 15-16	**ARRL Sweepstakes—Phone**
Dec 6-7	**ARRL 160-Meter Contest**
Dec 13-14	**ARRL 10-Meter Contest**
Jan 18	**FRACAP Worldwide Contest**
Mar 7-8	**1981 SSTV Contest**

plications and logs to: Hartwin E. Weiss W3OG, PO Box 440, Halifax PA 17032 USA.

EUROPEAN COUNTRY LIST:

C31, CT1, CT2, DL, DM, EA, EA6, EI, F, FC, G, GC Guer, GC Jer, GD, GI, GM, GM Shetland, GW, HA, HB9, HB0, HV, I, IS, IT, JW Bear, JW, JX, LA, LX, LZ, M1, OE, OH, OH0, OJ0, OK, ON, OY, OZ, PA, SM, S, SV, SV Crete, SV Rhodes, SV Athos, TA1, UA1346, UA2, UB5, UC2, UN1, UO5, UP2, UQ2, UR2, UA Franz Josef Land, YO, YU, ZA, AB2, 3A, 4U1, 9H1.

NEW JERSEY QSO PARTY

2000 GMT August 16 to
0700 GMT August 17

1300 GMT August 17 to
0200 GMT August 18

The Englewood ARA invites all amateurs worldwide to participate in the 21st annual NJ QSO Party. Phone and CW are considered the same contest. A station may be contacted once on each band; phone and CW are considered separate "bands," but CW contacts may not be made in phone band segments. NJ stations may work other NJ stations, and NJ stations are requested to identify themselves as "DE NJ."

EXCHANGE:

QSO number, RS(T), and ARRL section, country, or NJ county.

FREQUENCIES:

1810, 3535, 3900, 7035, 7135, 7235, 14035, 14280, 21100, 21355, 28100, 28610, 50-50.5, and 144-146.

Suggest phone activity on the even hours; 15 meters on the odd hours (1500 to 2100 GMT); 160 meters at 0500 GMT.

SCORING:

Out-of-state stations multiply the number of complete contacts with NJ stations times the number of NJ counties worked (21 maximum). NJ stations count 1 point per W/K/VE/VO QSO and 3 points per DX QSO. Multiply total QSO points by the number of ARRL sections (including NNJ and SNJ—maximum 74). KP4, KH6, KL7, etc., count as 3-point DX contacts and as section multipliers.

AWARDS:

Certificates will be awarded to the first-place station in each NJ county, ARRL section, and country. In addition, a second-place certificate will be awarded when 4 or more logs are received. Novice and Technician certificates will also be awarded.

ENTRIES:

Logs must show date/time in

Continued on page 150

Results

RESULTS OF THE 1980 SSTV CONTEST

What a blast! Enthusiasm and participation in the 1980 SSTV Contest was, to put it mildly, fantastic. Brooks Kendall W1JKF, Dave Ingram K4TWJ, and the complete gang at 73 would like to thank each and every contestant and invite you to do it again next year. This contest is rapidly gaining widespread popularity. If you haven't yet joined the ranks of SSTV operators, you best get cracking. This is, obviously, going to be one of the hottest modes of communication in the 80s.

During the weekend of March 8 and 9, 1980, practically all the designated frequencies were alive with the sound of SSTV. 10 meters was open like never before, with European video pounding into the US until mid-afternoon during both the contest days. 20 meters was also abound with SSTV, from approximately 14.225 to 14.240 MHz with several "levels" of SSTV signals. At one time during the contest, we noted a German slow scanner relating that in-shack efforts called for excessive work. The amateur said he was only making a few casual contacts and enjoying the "losing action." Down frequency from this operation, another SSTVer was busy making contacts while using felt-pen-lettered sheets placed under the camera during each QSO. We understand the paper menegene and hot lights soon choked the poor chap. One possible alternative to this situation is the new Robot super terminal or a house computer. Otherwise, we're open to alternate ideas. How about it, gang?

This year's contest resulted in a significant increase in the number of logs received, and, as evident by the comments received, most of you would like to see the schedule changed to stimulate more worldwide participation. Last year I conducted surveys during the Saturday SSTV network, and the suggestions received have been tabulated. We did not come to grips with this in time for this year's contest; however, next year will reflect a change in the schedule. If you wish to state your views, please let us know. The Saturday SSTV net that meets every Saturday at 1800 to 2000Z is a convenient way. Please call net control, W1JKF (handle is Brooks), on 14.230 MHz.

SSTV CONTEST SOAPBOX

"My first time in the contest, and it was terrific fun. It was enjoyed by all members of the family, and I even scored 2 new SSTV countries."—K0HT.

"Really had a ball, but where were the South Americans?" —WA4OAA.

"Had to take several intermissions, but kept plugging anyway."—K8EMI.

"KB9IG—you beat N6WQ—what's your secret?"—K4TWJ.

"Would like to see a divisor used that would divide power by same to determine score."—W0TUP.

"Really enjoyed contest and look forward to competing next year. My equipment is mostly homemade, with a modified SWTP computer—software by W8PVD and AA8D." —K8NTK.

"Enjoyed contest."—WA0LLQ.

"It was fun. My comments will follow."—W2GND.

"My first SSTV contest. Enjoyed same, but was severely limited by a stuck rotor."—WA1PEL.

"Best contest yet; good DX this year. Would like to see contest run 36 straight hours. Australia was just coming in when contest ended."—WB0RYP.

"Best regards on contest. Hope contest will continue and with more participation worldwide. Propagation is poor on 80 and 40 in Mexico. Would like schedule changed to take advantage of openings to JA and other countries. Big applause to *73 Magazine* for sponsoring contest."—XE1AAK.

WINNERS

Congratulations to Dick Rush KB9IG, the winner of this year's contest. Dick's score was 306 points. He worked 23 countries in 4 continents plus 33 states and provinces. Dick will receive a year's subscription to 73 and a winner's certificate, plus a certificate for the most countries worked.

N6WQ will receive a certificate for the most states and provinces worked: a total of 34.

WB0QCD will receive a certificate for the most continents worked—all six.

Listed below are the scores of the contestants.

KB9IG	306	W0TUP	200	WB9ZBG	126
N6WQ	277	WA0LLQ	200	K8EMI	125
WB3APB	256	W2GND	196	WA1PEL	114
W1WS	214	WB3KOJ	160	WB0QCD	109
K0HT	212	W6WDL	156	XE1HT	102
WB0RYP	211	W3CJI	151	XE1AAK	34
KA1AQM	208	K8NTK	149	W7FEN	32
WA4OAA	204	K8HAB	127		

Thanks for participating in the contest, fellers. I guess this wraps it up for this year. See you in 1981, first full weekend in March. Read Dave's articles in A5; hope to see you on the SSTV net Saturday at 1800Z on 14.230 MHz. See you down the log.

Dave Ingram K4TWJ
Brooks Kendall W1JKF

Awards

Bill Gosney WB7BFK
Micro-80, Inc.
2665 North Busby Road
Oak Harbor WA 98277

It is hard to believe that almost one year has passed since our initial accouncement of the famous *73 Magazine* awards portfolio. During this period, we've seen the program grow significantly to become one of the most sought-after challenges facing amateurs today.

Consisting of six domestic incentives and five DX achievement programs, the awards portfolio has captured the interest of almost everyone on the band, whether a rag chewer or a big-time contester.

In the paragraphs to follow, I am listing the DX awards individually. Read through the rules with caution. The requirements are not as easy as one might first imagine. We want our award recipients to realize that they had to "earn" their recognition and therefore have designed each award to be somewhat of a challenge. Next month the domestic awards will be featured.

73 DX COUNTRY CLUB AWARD

1. Sponsored by the editors of *73 Magazine*, the *73* DX Country Club Award is available to licensed amateurs throughout the world.

2. To be valid, all contacts claimed must have been made in a *single calendar year* (January 1 through December 31), beginning on or after January 1, 1979.

3. This award is issued for All Phone, All CW, and Mixed Modes. Should you wish to recognize a single band or mixed band accomplishment, merely state your request when submitting your application.

4. To qualify for any of the *73* DX Country Club Awards, a minimum of 73 DX countries must be worked and confirmed from the *73 Magazine* WTW (Work the World) DX listing which appears elsewhere in this column. Once again, all contacts must be made in the same calendar year for which application is made.

5. Annual endorsement stickers are available for each succeeding year in which application is made.

6. To apply, prepare a list of claimed contacts in prefix order. Include each station's callsign, date and time in GMT, mode, and band of operation.

7. Do not send QSL cards! Have your list of contacts verified by two amateurs, a local club secretary, or a notary public.

8. The award fee is $3.00 or 8 IRCs for each award. Endorsements are granted for a fee of $1.50 each.

9. Send your verified list and award fee(s) to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

DX CAPITALS OF THE WORLD AWARD

1. Sponsored by the editors of *73 Magazine*, the DX Capitals of the World Award is made available to licensed amateurs the world over.

2. To be valid, all claimed contacts must have been made on or after January 1, 1979. There are no band or mode restrictions, although special recognition will be given for single band or mode accomplishments if requested in the application.

3. To qualify, you must work and confirm fifty (50) different national capital cities of the world. Only those countries which appear on the WTW DX listing qualify. Should a country with a national capital city not commonly known be contacted, you may list it on your application; the awards editor reserves the right to make a final determination as to its acceptance for award credit.

4. To apply, make a self-prepared list of contacts made in prefix order. Indicate the station callsign, date and time in GMT, band and mode of operation, name of the capital city, and DX country.

5. Do not send QSL cards! Have your list of contacts verified by two amateurs, a radio club secretary, or a notary public.

6. Send your application list and award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

TEN-METER DX DECADE AWARD

1. Sponsored by the editors of *73 Magazine*, the Ten Meter DX Decade Award is available to licensed amateurs worldwide.

2. All contacts must be made on the 10-meter band using only channelized converted Citizens Band equipment or similar commercial units operating a minimum of 15 Watts PEP output. External amplifiers may not be used.

3. To be eligible for this award, all contacts must have been made on or after October 1, 1978. Contacts may be claimed for all AM, SSB, CW, or FM. Mixed mode accomplishments are not valid for this award.

4. To qualify, you must work and confirm at least ten (10) DX countries from the WTW (Work the World) listing. Endorsements will be given for 25, 50, 75, and 100 countries confirmed.

5. To apply, make a self-prepared list of contacts claimed, giving the callsign of each station worked in prefix order. Include the date and time in GMT, band, mode, and a brief description of the equipment used in making each contact. Special recognition will be given for QRP mobile achievements.

6. Do not send QSL cards! Have your list of contacts verified by two amateurs, a local radio club secretary, or a notary public.

7. Send your application and award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

SPECIALTY COMMUNICATIONS ACHIEVEMENT AWARD CLASS A-1

1. Sponsored by the editors of *73 Magazine*, this award is dedicated to amateurs worldwide who take pride in active participation in the field of specialty communications.

2. To be eligible for this award, some very rigid requirements must be met. All contacts must have been made on or after January 1, 1980. Only communications via SSTV, RTTY, EME (Earth-moon-Earth), and/or OSCAR will be recognized for award credit. Contacts between stations on OSCAR and EME may be made using any mode authorized in your country, although applicants are cautioned that mixed mode contacts are not valid.

3. To qualify, applicants must work a minimum of 10 DX countries from the WTW DX listing. Special recognition will be made for those exceeding the 10 country minimum.

4. To apply, you must prepare a list of claimed contacts in callsign prefix order. Include the date and time in GMT, the band and mode of operation, and a signed declaration as to the type and description of equipment and antenna system utilized to make your contacts.

5. Do not send QSL cards! Have your list verified by two amateurs, a local club secretary, or a notary public.

6. Send your application and award fee of $3.00 or 8 IRCs to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

WORK THE WORLD DX AWARD

To enhance the enjoyment of working DX, the editors of *73 Magazine* take special pleasure in presenting the most complex and probably the most sought-after award in existence today – the Work the World DX Award.

1. Sponsored by the editors of *73 Magazine*, the Work the World DX Award is available to licensed amateurs the world over.

2. To be valid, all contacts must have been made on or after January 1, 1979. There are no band or mode restrictions; however, applicants will be given recognition for single band or mode achievements upon their request. Only DX countries shown on the WTW (Work the World) DX listing qualify.

3. The Work the World program consists of six continental awards (North American, South American, European, Oceanic, Asian, and African), each of which is a worthy accomplishment in its own right. Once the applicant has made application for all six achievements, a seventh and ultimate award known as the Work the World DX Award will be issued automatically without charge. The operator who earns WTW recognition has truly "worked the world."

4. Requirements for the individual continental awards: North American award—work

Continued on page 158

TRAC

Features:
- State-of-the-Art-CMOS Circuitry
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  - B. Twelve 25 character messages
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  - C. programming
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- Use for daily QSO or contests

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Features:
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- Use for daily QSOs or contests

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- Iambic keying with any squeeze paddle
- 5-50 wpm
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- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid state rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

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MESSAGE MEMORY KEYER

✔76

MODEL TE144 – Deluxe CMOS Electronic Keyer $59.95

MODEL TE133 – *same as TE144 with wgt. and tone control internal, less semi-auto keying.* $49.95

MODEL TE122 – same as TE133 less wgt., tune, solid state keying $36.50

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30
70
10
30
75
100
150
200
250
OFF
BATTERY

- **Learn the truth about your antenna.**
- **Find its resonant frequency.**
- **Adjust it to your operating frequency quickly and easily.**

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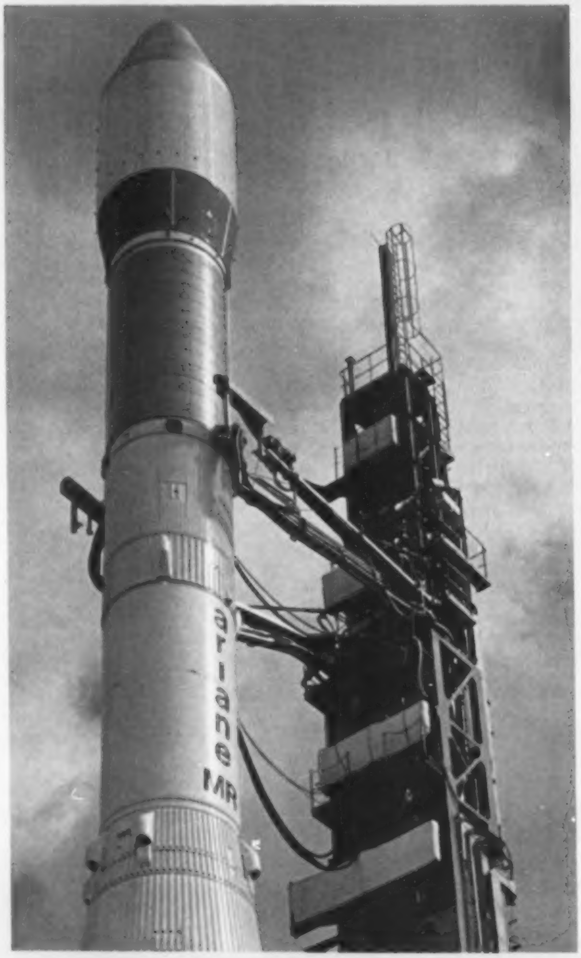
AMSAT

PHASE III TRAGEDY

The morning of May 23, 1980, began in hopeful anticipation and ended in devastating disappointment for radio amateurs throughout the world. This was the day of the long-awaited launch of hamdom's ninth OSCAR satellite, constructed by hams in several countries under the auspices of AMSAT, the Radio Amateur Satellite Corporation. As hundreds of amateurs tuned in to the AMSAT Launch Information Nets, a rocket motor failed in the first stage of the *Ariane* launch vehicle, causing the destruction of both the missile and its satellite payload.

The amateur satellite aboard the ill-fated mission was the first of the Phase III designs, created to operate from high elliptical orbits. Much more sophisticated than the previous amateur satellites, the Phase III bird would be available for long-distance communications for hours at a time. Development and construction of this first Phase III satellite (to become known as OSCAR 9 after successfully achieving orbit) took more than five years and cost a quarter million dollars.

The launch took place from the European Space Agency (ESA) complex at Kourou, French Guiana, on the northeast coast of South America. ESA had successfully tested its *Ariane* rocket last December by firing a mostly inert payload into space from Kourou. This time, *Ariane* carried the *Firewheel* scientific satellite as its primary payload, with the Phase III bird as secondary cargo.



Launch day was plagued by a series of annoying delays as controllers wrestled with several small problems, including a sticking valve, a computer error, and a rainstorm at the launch site. Then, shortly before 1430 UTC, everything seemed in order and the countdown reached its conclusion. On the AMSAT 40-meter net, Dr. Thomas A. Clark W3IWI, now president of AMSAT, kept amateurs informed. At first, everything looked good:

"9 . . . 8 . . . 7 . . . 6 . . . 5 . . . 4 . . . 3 . . . 2 . . . 1 . . . mark."

"Ignition comfirmed . . . liftoff confirmed."

"Flight is nominal."

"Everything is on track."

Then, a hint of trouble:

"We have the report that both transponders are off."

"We have a report there's a problem on one engine."

"The flight is not nominal. There's a problem on one engine."

And, finally:

"We just had the report: The launcher is going down. The launcher is going down."

"It appears that the launch was a failure."

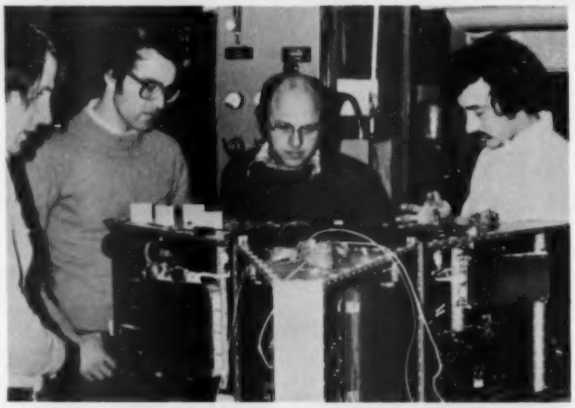
"The frustration level is extremely high . . ."

Telemetry signals from the *Ariane* showed that one of the four Viking-V engines in the first stage had begun losing thrust almost immediately after liftoff. The flight computer had attempted to compensate with the other three engines, but eventually lost the battle as the thrust from the failing engine continued to decline. As it began to go out of control, the *Ariane* rocket was destroyed, and with it, the Phase III satellite. It is small consolation that the amateur satellite worked perfectly, while the "professional" rocket failed.

Later on launch day, interested hams met on 75 meters to discuss the events of the day. With W3IWI as master of ceremonies, a large number of amateurs spoke up in support of the amateur satellite program. It was pointed out that two functioning satellites, OSCARs 7 and 8, remain in daily use by hundreds of hams. Also, AMSAT already has some of the major components of a second Phase III satellite, and it's estimated that the new bird could be made ready in about a year's time. A more difficult problem may be finding a suitable launch opportunity. With NASA launching very few payloads until the Space Shuttle is operational, space aboard launch vehicles is at a premium.

The AMSAT budget has been severely strained by the Phase III program. It was hoped that a successful OSCAR 9 launch would bring many new members into the organization, with the resulting infusion of badly needed funds. With the frustrating loss of the Phase III bird, AMSAT must count on the support of interested amateurs while a new satellite is prepared and launched.

If you are interested in learning more about the amateur satellite program, simply write AMSAT, PO Box 27, Washington DC 20044.



Pre-flight testing of the Phase III satellite was carried out by (left to right), among others, Jan King W3GEY, Ulrich Muller, Dtor. Karl Meinzer, and Clark Greene. The two in the center are from AMSAT Deutschland. (Photo courtesy of G. D. Moreno LU4EDS/W3)

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New Products

HEATHKIT SA-2040 ANTENNA TUNER

Sometime around 1955, I had my first encounter with Heathkits when I purchased an AR-2 general coverage receiver. It was quite an undertaking. (I almost died when I thought of the apparent hoplessness of the bags and bags of screws, resistors, and other assorted parts that I had bought with the pain and agony of foregoing my lunch at school.) I was a real novice and really knew very little about what was what, but Heathkit apparently knew this and put things in such simple terms that I had little difficulty in "getting it together".

Several Heathkits and twenty-five years later, I found the need for a transmatch and, from what I could tell, the new Heathkit SA-2040 seemed to be just what I needed. Off to the Heathkit store I went. The salesman produced one from the back room while telling me how lucky I was to get one as they seemed to be selling so well. I told him that I thought I was lucky, too (and privately hoped that I was, since I hadn't received the bank confirmation of the automatic payroll deposit to cover the check I was writing).

When I got the SA-2040 kit home, I opened the box and found what looked like a hardware store. I was a bit disappointed to find that the packer back at the Heathkit factory had smashed one of the aluminum skirts on one of the knobs, but I considered it to be a minor setback and just hoped it wasn't an omen of things to come.

The instruction manual (Heathkit part #595-2327) was accompanied by an eight-page supplement of changes which bore the new Heath-Zenith logo. I quickly found out that the changes that were to be made to the "Illustration Booklet" couldn't be done, as they apparently forgot to pack it in the box. The absence of that booklet later proved to be a pain-in-the-neck to me and caused me to have to take a lot more time than would have really been necessary.

Instead of the usual "exact number" inventory that I'm used to with Heathkits, I found there was generally a surplus of the hardware items, but the 3/16" capacitor stator spacers were short by one piece. While that doesn't sound like much of a shortage, it proved to be quite a problem since the antenna capacitor just won't go together, Illustration Booklet or no Illustration Booklet, without all four 3/16" spacers. Fortunately, I had an extra 17/64" stator spacer, a small file, and some patience, so I was able to make a substitute part.

In spite of all the manual changes and my having to use my imagination in lieu of the Illustration Booklet, the kit went together with little difficulty. (The assembly very much reminded me of playing with an Erector Set as a kid!) Once Heathkit reprints the manual with the changes, and perhaps includes the Illustration Booklet, there should be no problem putting the kit together within the two-evening time frame mentioned in the new Heathkit catalog. Even with the problems that I had, I managed to get my first 1:1 match with the SA-2040 during the second after-dinner session.

Heathkit has really put together a nice transmatch kit. It comes with an attractive black and grey cabinet with a full-size face piece with a place to record your tuning settings. They've used the old reliable handbook-type circuit, complete with balun and continuously variable inductor.

My only criticism is that the kit is new and Heathkit just hasn't yet debugged the manual and box packing procedures. My guess is that they've simply gotten too anxious to get the SA-2040 into the hands of all those "lucky" buyers, but if I know Heathkit, that overeagerness will be taken care of by their customer service policy and corrections in future kits will be forthcoming in the immediate future.

The salesman who told me I was lucky to get an SA-2040 before they sold out was probably right, since they will likely go like hotcakes once the word gets around. Frankly, I've been in the market for a tuner for some time and have been shopping around quite a bit. Considering the cost of the various commercially manufactured tuners and parts for homebrew tuners, I consider the SA-2040 to be an excellent value.

For further information, contact *Heath Company, Benton Harbor MI 49022.* Reader Service number 482.

Tony Stalls K4KYO
Washington DC

CW STATION IDENTIFIER

Spectrum's Model ID 1000 automatic Morse CW station identifier is a 1-2 channel, stored program unit designed to interface with any existing base station or repeater transmitter—either solid-state or tube. This new IDer features automatic identification of the station, either at completion of activity or at 15-30 minute intervals, built-in ac power supply, and optional provision for 12 V dc battery input with automatic switchover to special "Emergency Power ID". CW tone pitch, speed, level, and time are adjustable. The transmitted code signal is a pleasant sinusoidal note, and the unit has an output capacity of up to 6 V p-p into a 600-Ohm or greater load. A plug-in PMOM chip is used to store the memory.

For further information, contact *Spectrum Communications Corporation, 1055 W. Germantown Pike, Norristown PA 19401; (215)-631-1710.* Reader Service number 481.

NEW TEN-TEC "DELTA" TRANSCEIVER

The new Ten-Tec "DELTA," in keeping with its name, offers a transceiver for the changing times. Covering 160 through 10 meters, the DELTA has the present 6 HF bands plus the new 10, 18, and 24.5 MHz segments (available when the bands open for use).

The wholly new design features a new low-noise double-conversion receiver with 0.3 uV sensitivity, 85-dB or better dynamic range plus switchable 20 dB attenuator, standard 8-pole monolithic SSB filter with 2.4-kHz bandwidth, optional 200-Hz and 500-Hz 6-pole CW filters, and standard 4-stage ac-

ANTENNA TUNER

Heathkit's Model SA-2040 antenna tuner.

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ID 1000
AUTOMATIC CW IDENTIFIER

Spectrum's new ID 1000 CW station identifier.

Ten-Tec's new "DELTA" transceiver.

tive audio filter, built-in variable notch filter, offset tuning, new "hang" agc for smoother operation, optional noise blanker, WWV reception, and new digital readout featuring six 0.3" red LEDs.

For further information, contact *Ten-Tec, Inc., Highway 411 East, Sevierville TN 37862.*

AEA KT-1 KEYER TRAINER

Advanced Electronic Applications created a sensation among CW devotees with the introduction late last year of the MorseMatic, a superb microprocessor-controlled electronic memory keyer. Now comes AEA's KT-1 Keyer Trainer, a compact electronic keyer and Morse training device that incorporates many of the most popular features of the MorseMatic, but is available at a substantially lower price.

The Keyer

For someone familiar only with conventional electronic keyers, the lack of knobs and switches on the control panel of the KT-1 is surprising. In fact, only the on-off/volume control is immediately recognizable. Every other function, including speed, sidetone pitch, weighting, tune, and more, is programmable, using the 12-button keypad to address the microprocessor hidden inside the KT-1's black plastic case.

Don't let this talk of keypads and microprocessors make you nervous; AEA has provided a concise yet complete instruction manual that will have your fingers dancing merrily on the keys within a few minutes. For convenience, you'll probably commit the most often used commands to memory, but this will occur naturally after a few hours of use.

Keyer speed is variable from 1 to 99 words per minute. The command for changing speeds is typical of the keypad combinations used to control the unit. A new speed is selected by simply pressing the "*" and "6" keys, followed by the desired speed. A speed of 25 wpm requires the combination "*625", for instance. A newcomer might select "*607" to transmit at 7 wpm. Similar commands allow you to vary the pitch of the sidetone (there's a built-in speaker), change the weighting, turn the dot and dash memories on and off, send a continuous tone for transmitter tuning, and even set up the keyer for semiautomatic (bug) and straight key operation.

The Trainer

It's difficult to imagine a better gadget for helping someone learn Morse code or increase his speed. Stored inside the KT-1 is a sequence of 24,000 Morse code characters. For code practice, 10 different starting points are available, selected by the keypad digits. In the unlikely event that you happen to memorize the character sequence at one or more of the 10 starting points, a random starting point may also be chosen.

As with the keyer functions, almost every aspect of the trainer is controlled by the keypad. Especially noteworthy is the option of using the Farnsworth method of code training. In this method, the individual Morse characters are sent at a high rate of speed with longer-than-normal spaces between the letters. For many people, this leads to a rapid increase in code speed, since the ear becomes accustomed to the sound of the high-speed characters. As training progesses, the inter-character spaces are gradually shortened, while the character speed remains unchanged. The result is a steady increase in speed without the need to re-learn the sound of each character.

The KT-1 can be programmed to provide practice sessions up to an hour in length, with selectable starting and finishing speeds and five-character or random length code groups. Code class instructors, please note.

Conclusion

The KT-1 requires a source of 12 V dc for operation; an ordinary wall-plug transformer will do the job. The keying circuit is designed to handle most any ham transmitter or transceiver and is rated at −300 V and 30 mA or +300 V and 300 mA. One complaint about the KT-1: The hard plastic case tends to slide around on the operating desk. It really needs a set of rubber feet to prevent this.

For those who do not feel the need for the memory and beacon functions found in AEA's top-of-the-line MorseMatic keyer, the KT-1 Keyer Trainer seems an ideal choice.

For further information, contact *AEA, Inc., PO Box 2160, Lynnwood WA 98036.* Reader Service number 478.

Jeff DeTray WB8BTH
Assistant Publisher

HAMTRONICS' CONVERTERS AND AMPS

Hamtronics' transmitting converters and heavy-duty linear power amplifiers are now available as complete units, in eggshell-enameled aluminum cases, with BNC connectors for exciter and antenna connections. These units, which are compatible with virtually any ten-meter SSB, CW or FM exciter, provide an rf output of 30 to 45 W PEP with as little as 1 mW input. Models are available for 432-450 MHz, which includes operation on OSCAR, and for six meters and two meters. These units provide a versatile arrangement for getting on either satellite or terrestrial operation.

A complete new catalog on these and other VHF/UHF transmitting and receiving modules for FM and SSB is available from *Hamtronics, Inc., 65F Moul Rd., Hilton NY 14468.* Reader Service number 476.

THE COLLINS/ROCKWELL KWM-380

Continuing a tradition of high quality communications gear known and respected in amateur circles since the 1930s, Collins/Rockwell International recently introduced their latest high frequency transceiver—the KWM-380. Bearing a resemblance to its predecessors, the KWM-1 and KWM-2A, primarily in high caliber performance and advanced internal design, the KWM-380 is packaged in a heavy-duty cabinet which weighs in at close to 40 pounds.

Continued on page 161

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Don Wagner W2QFC
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The Soft Mount

—mobile mount enters the space age

"Ouch, that stuff smarts!" I said, half aloud, as I applied first aid to my skinned knuckles for what seemed to be the hundredth time.

It was a ritual I had not learned to live with and it was happening altogether too frequently. It seemed as though I managed to need some sort of first aid every time I took one of the mobile rigs out of the car, or when I put one in, or when I swapped the Argonaut low-band transceiver with the Amcomm two-meter rig, or vice versa.

The big problem was, of course, that the rigs are of vastly different dimensions (aren't they all?) and each presented its own mobile-mounting problems. I found myself constantly messing around with various lengths of straps, screws and bolts of varied types and sizes, nuts and wingnuts, all difficult to hold in place and most requiring that new holes be drilled in the automobile. And then I had to start all over again every time a new rig was to be mounted.

Consider the number of times you go through a similar ceremony, when, for example, you take the rig into the shack for fixed use or for adjustments, when you store it in the trunk for security, or whenever you decide to QSY from LF to VHF, etc. There must be a better way, I thought, as I hung the mike on its Velcro® fastener on the side of the rig. But so far none of the magazines or catalogs seemed to offer solutions.

Photo A. The mount in position, covered with Velcro and some dust.

Wait a minute! *Velcro!* Why not? If a small piece of this fastener does such a great holding job for a mike, why not use lots more of it to hold a rig in place, especially rigs like the Arogonaut and Amcomm?

First, a trip to the local fabric emporium produced an abundant supply of Velcro tape on reels, in several widths and in several colors. I purchased a yard of the greatest width in stock, about an inch and one-half, and in black. The clerk gave me a leaflet about this material. It is a product of the Talon Division of Textron and is called a "self-gripping fastener." It consists of two pieces of fabric backing, one of which has tiny, firm nylon hooks and the other, soft nylon loops. These interlock when pressed together and hold with surprising strength, yet peel apart easily. If you have not used it, I imagine the lady in your house is familiar with it as a clothing fastener. If, however, you have had your blood pressure checked recently, the chances are that the arm cuff used Velcro fastener to hold it in place. And be sure to check your fly—for Velcro tape, I mean! Many men's and ladies' trousers use it there, too.

Next, a trip to the electronics emporium. It produced a great variety of types, sizes, and construction (metal and plastic) of hump floor mounts. I selected a rather heavy steel job that had a neatly sloping top and slants the radio dial and knobs at a good angle for viewing and handling from the driver's seat. The junk box produced a pair of sturdy aluminum straps that were bolted to the rim at the back of the mount and bent (contoured) upward and around the air-conditioning ducts. They are fastened to the underside of the dash rim and provide good stability for the mount.

The Velcro tape is glued to the top of the mount, laying the strips next to each other so that the top is completely covered, thus providing maximum versatility for any rig to be mounted on it. I used the "fuzzy" half of the Velcro tape on the mount and

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✓ Reader Service—see page 195

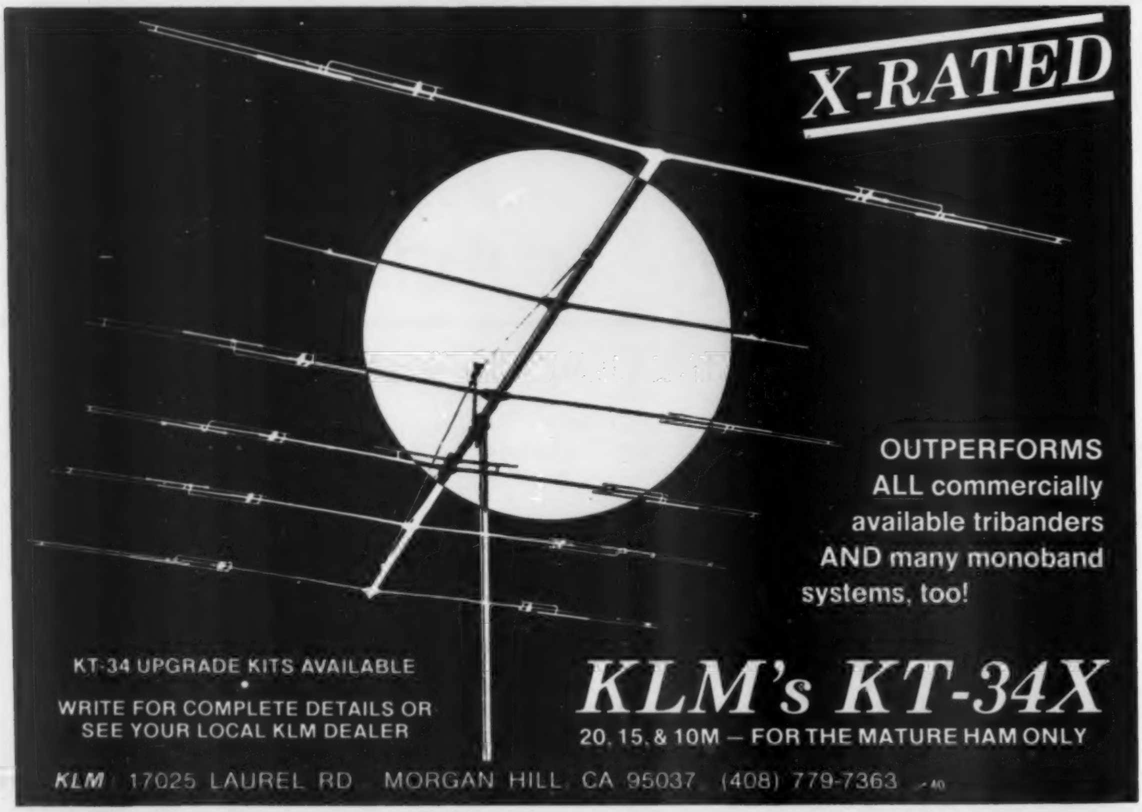
Photo B. The Argonaut in place.

Photo C. The Amcomm in place.

glued it with one of the newer "instant adhesives" or super glues. It has held the tape in place without problems for over a year, through six months of Arizona sun and through some severe western New York State winter weather, too.

The other half of the Velcro tape is glued to the bottom of the rigs, of course, placed carefully so that the rig will be in good position for you, making certain that none of the screws or the speaker grill is covered, hi. Leftover pieces make great cushions on the vertical straps to protect the cabinets, and for "hangers" for your mike, touchtone pad, mini frequency counter, and field-strength meter.

Having done this, you are ready for just about any rig of reasonable size—ready to go mobile without straps, holes to drill, screws and bolts, etc. All you need is more Velcro material! Your rigs will stay put; you will really be amazed at the holding power which this material provides while requiring only a "little pull to pull it off."■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FT-707 is shown with optional FV-707DM VFO & Scanning Microphone

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THE FT-707 "WAYFARER"

The introduction of the "WAYFARER" by Yaesu is the beginning of a new era in compact solid state transceivers. The FT-707 "WAYFARER" offers you a full 100 watts output on 80-10 meters and operates SSB, CW, and AM modes. Don't let the small size fool you! Though it is not much larger than a book, this is a full-featured transceiver which is ideally suited for your home station or as a traveling companion for mobile or portable operation.

The receiver offers sensitivity of .25 uV/10 dB SN as well as a degree of selectivity previously unavailable in a package this small. The "WAYFARER" comes equipped with 16 poles of IF filtering, variable bandwidth and optional crystal filters for 600 Hz or 350 Hz. Just look at these additional features:

FT-707 with Standard Features

- Fast/slow AGC selection
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- WWV/JJY Band
- Bright Digital Readout
- Fixed crystal position
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FT-707 with Optional FV-707DM & Scanning Microphone

- Choice of 2 rates of scan
- Remote scanning from microphone
- Scans in 10 cycle steps
- Synthesized VFO
- Selection of receiver/transmitter functions from either front panel or external VFO
- "DMS" (Digital Memory Shift)

Impressive as the "WAYFARER" is its versatility can be greatly increased by the addition of the FV-707DM (optional). The FV-707DM, though only one inch high, allows the storage of 13 discrete frequencies and with the use of "DMS" (Digital Memory Shift) each memory can be band-spread 500 KHz. These 500 KHz bands may be remotely scanned from the microphone at the very smooth rate of 10 Hz steps.

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Notes from Big Sky Country

— the further adventures of Dr. Hess

Dr. William C. Hess W6CK
PO Box 19-M
Pasadena CA 91102

WESTLAND RADIO
KGCX

KGCX employees during the thirties included (L to R) Announcer Adolph Jystad, who obviously has just left his employment at the Westland service station to have his picture taken at the Westland radio station, Engineer George Bairey, later to become a consulting radio engineer in Washington, DC, and Engineer Eddie Richmond, who is now a practicing attorney in Portland, Oregon. The dog appeared out of nowhere, "adopted" KGCX, and filled the only position at the station for which he was qualified—Night Watchman.

In the November, 1970, and June, 1979, issues of this magazine, Dr. Hess regaled our readers with stories of interesting and often hilarious incidents which occurred in the states of Montana and North Dakota when he was a young man living in that area, with special emphasis on the flamboyant early history of radio station KGCX. Here's more of the same, together with a few tales of the early days of radio and television in Los Angeles.—Ed.

The year was 1918. The terrible flu epidemic, which caused the deaths of millions of people that year, was raging full blast in my home town of Noonan, North Dakota, and in every other community in the world.

The Noonan Farmers Telephone Company, doing its bit to try to end this dreaded disease which was rapidly killing its customers, "sent away back east" for a supply of white celluloid discs, approximately three inches in diameter and about an eight of an inch thick. These discs contained the drug asafetida (also known as "devil's dung"), which was thought at that time to possess germicidal qualities. (In Noonanese, one never merely said that he had mailed an order to a firm in the eastern United States—one always said that he had "sent away back East." "East" was everywhere beyond Minneapolis.

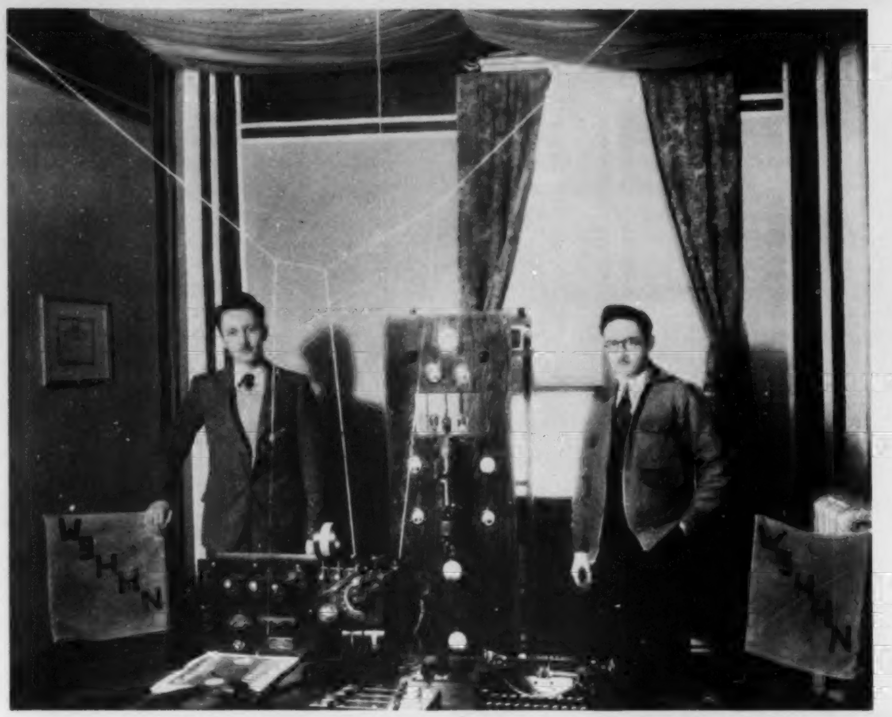
By unscrewing the hard-rubber mouthpiece of the single-button carbon microphone used in the hand cranked wall telephones then used at Noonan, one of these celluloid discs (which had a one-inch diameter hole in their centers) could be placed flat against the remaining portion of the "talk-into" part of the phone and held firmly in place by replacing the mouthpiece in its original position.

One thing these discs did for sure was keep people from depositing droplets of bacteria-laden moisture from their breath on their telephone mouthpieces, since the absolutely sickening odor of the asafetida made it very unpleasant indeed to stand too near the telephone.

My buddy, Pa Ness, was the lineman for the telephone company. He regularly patrolled the lines around Noonan, replacing broken or missing insulators on the poles (the cause of which was some mean kid equipped with a .22 rifle) and replacing the number-6 dry cells which powered each phone.

While driving up to a farm home, he noticed a cloth "Bull Durham" tobacco sack hanging from the iron telephone wire just before it entered the wall of the house. Upon inquiry as to the purpose of this sack, it developed that the farmer had observed the asafetida devices on the business phones in Noonan, and, wishing to take no chance of contracting the dreaded flu over the telephone, he had purchased some asafetida from the village druggist, placed it in the tobacco sack, and hung it *outside* his home. This gave the dreaded influenza bacteria no chance whatsoever of entering his home via the telephone! Even if he should receive a long-distance call from his relatives in Minneapolis where the flu was killing dozens of people every day, the germ coming over the phone wire would meet the medicine in the sack in a head-on collision and be given a double whammo. No dummy he, that would allow such a killer to come right into his home.

Another calamity hit the town about twelve years later, when the federal government licensed Pa Ness and myself as amateur radio operators and assigned us the callsigns of W9CHG and W9HHN, respectively. All that was necessary to secure an impressive-looking license (which was of the same important-looking size and the same bluish complexion as today's commercial operator licenses) was to visit a notary public (my father, in our case) and sign an affidavit stating that you could, indeed, send and receive ten words per minute in international Morse code and that there was very little, if anything, that you didn't know about radio theory. However, it did not state anywhere in the affidavit that the ten words could not be the same word, such as "it," repeated over and over.



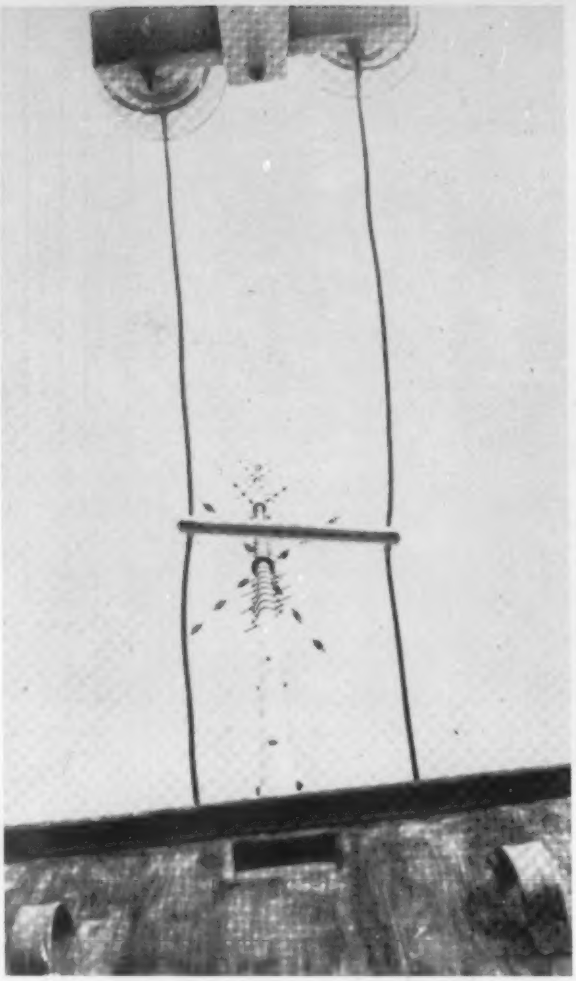
Pictured above is the author and the college radio station he built in 1932 for the North Dakota State School of Science. The 204A tube was mounted on the front of the transmitter as was the universal custom in those days. The antenna stretched from the steeple of four-story "Old Main" to a steel tower on another building. The older man is Mr. Linsky, a radio theory instructor at the college.

We didn't interfere with the radio reception of the other residents of the town, provided their radios had two or more tuned radio frequency stages. Those unfortunates, such as the town postmaster, who owned cheap radios with a wide-open front end received us "sixty over" in several regrettable places on their radio dials, mostly on the very frequencies that the few stations which were receivable in that remote area of the United States were trying to broadcast on.

In fact, you didn't need a radio of any type to receive the 160-meter AM signal of W9CHG in certain locations. He and his wife, a registered nurse, operated the local hospital and lived in an apartment in the basement of the hospital. Employees in the hospital kitchen often became candidates for residency in Dr. Pierce's Sanitarium for the Trembling when the mere removal of a lid from a pot of food simmering on the hospital's electric stove and the laying of that lid down on an adjacent burner element of the stove caused CHG's booming voice to roar forth from the stove, with volume such as one might hear from a public address system at the county fair. Somewhere within the anatomy of the stove, dissimilar metals were rectifying the signal of W9CHG, and the pot lid, when placed on another burner element, served as sort of a speaker cone to reproduce the sound.

After daily radio conversations for several months with a couple of VE4s about sixty miles away in neighboring Canada, we thought it would be nice to have an eyeball contact with them. Over-the-air arrangements were made with them on a day in June, 1931, whereby we would visit them the following day.

We headed toward Canada the next morning about 8 am. Prohibition was



This view looks straight up the 200-foot antenna mast of KGCX at Wolf Point. Since it was impossible to climb it, the FCC waived the requirement that it be equipped with red lights and allowed it to be illuminated by floodlights on the ground. Still in use at Sidney where KGCX is now located, it gives one the impression of being apt-to-fall-down-at-any-minute, due to its crooked appearance. This was caused when vandals at the latter city cut one of its guy wires and the tower came down much faster than it was erected.

still in effect in the United States, so after reporting to Canadian Customs and Immigration at Estevan, Saskatchewan, we stopped at His Majesty's Government Liquor Store, where we bought a case of White Horse Ale, some bottles of Teacher's Cream Whiskey, and several gallon jugs of port wine (realizing that the store would likely be closed upon our return from our safari further into Canada). Purchases were restricted at these stores to Canadian citizens, so we signed the order form "Reginald Barrington-Smythe." How British can you get?

With preparations thus made for a liquor-smuggling trip back into the United States following our eyeball contact with our Canadian ham friends, we set a northeast course with CHG's Chevy and arrived at the home of one of the VE4s to find a somewhat less than deluxe ham radio installation. Our host immediately lit a homemade cigarette by holding a shovelful of red-hot coals from the kitchen range up to his face, burning off his eyebrows in the process. When we asked why he used this rather large cigarette lighter, he explained that he couldn't afford to buy matches.

His rig was a raw ac self-excited oscillator, capable, of course, of producing only CW signals. It was built in a wooden apple box. The dials were tomato can covers which he had soldered directly onto the brass shafts of the variable capacitors. His antenna was one of the iron wires of his mother's clothesline, suspended about five feet off the ground. On Mondays (wash day), his rig wouldn't load up, due to the wet (or frozen) laundered clothing and bed sheets draped over his clothesline antenna.

He turned on his receiver and we heard the beautiful 20-meter AM signal of W8CPC from Buffalo NY, who was calling CQ. The result was a QSO between that station and our VE4 friend, using his raw ac code signal.

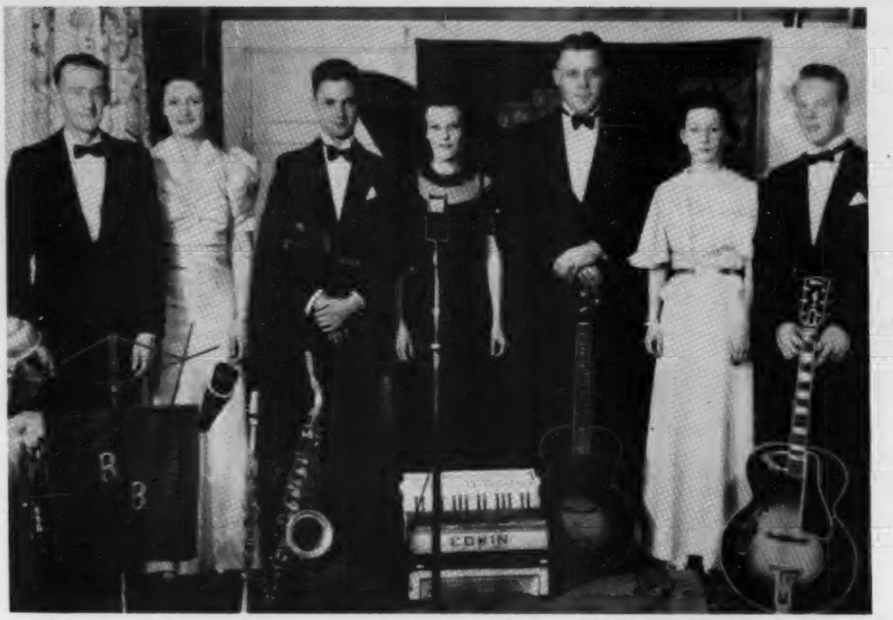
During that era, *QST* used a few pages each month to describe and picture the Station of the Month. A few months later, W8CPC was featured as the Station of the Month. Its kilowatt-on-every-band operated by a prominent Buffalo doctor was described, and we were struck by the difference in value of the equipment used in the QSO. Our Canadian friend's gear was worth about $5.00. The investment on the Buffalo end was more like $5,000.

After being dinner guests of the other VE4, we headed for home about 5 pm. Shortly after crossing the international border, which is nine miles from Noonan, we noticed an automobile several miles away, coming toward us. Realizing that this car could mean trouble for us, in the form of Border Patrol officers, I focused the long telescope which CHG always carried in his car on the approaching vehicle. I could see that its occupants were wearing Smokey-the-Bear-type military hats, so we knew that the Border Patrol was indeed approaching. CHG brought the Chevy over to the extreme right-hand side of the narrow dirt road and continued driving slowly while I opened the car door a little and gently eased our entire cargo of liquor into the tall weeds which grew right up to the edge of the road.

We were stopped by the Border Patrol officers and our vehicle, including the trunk, was thoroughly searched. Of course, nothing illicit was found.

During the long days of June in North Dakota, it stays almost like daylight in the evenings until about 10 pm. A newspaper can, in fact, be read outdoors at that hour without benefit of any artificial light. We drove past the Chief Border Patrolman's home about 8 pm and saw, through his living room window, that he had settled down for the evening to read the *Minot Daily News* which had arrived on the 7 pm train. He had his pipe (which resembled a small saxophone) fired up full blast. We concluded that there would be no more border-patrolling done until the next day.

So, we went back toward the border. We had taken careful note of where we had hastily dumped our contraband, so it was easy to find.



The Rainbow Players, pictured above, performed daily on KGCX. Every day of the year, they left Wolf Point in two cars, towing luggage trailers to carry their instruments, for some town within a 150-mile radius of Wolf Point to stage a play, followed by a dance. Their association with KGCX was a symbiotic one, the radio station deriving free live entertainment each day and The Rainbow Players obtaining a lot of free advertising for their performance that evening in some Montana or North Dakota town.

Not a bottle or jug was broken. The smugglers had met the challenge and conquered it. *Note to the United States Attorney for the District of North Dakota:* You silly man, take those indictment forms charging Pa Ness and me with International Smuggling which you have been feverishly typing after reading thus far in this article out of your typewriter and throw them in your wastebasket. The Statute of Limitations on this terrible crime "ran out" forty years ago.

Pa Ness was a good carpenter, so his next project that summer of '31 was to build an eight-by-ten-foot playhouse for his little daughter, Patsy, on the hospital grounds. As soon as the paint was dry, she moved her dolls, her doll buggy, and her other playthings into this structure, which was wired for electricity. The dolls had iron weights attached behind their eyeballs so that they would "sleep" when laid horizontally and would "wake up" when set in a vertical postion. However, these dolls soon fell into a permanent horizontal coma when Patsy lost her lease on this building in less than twenty-four hours when a powerful thought crashed across the synaptic clefts of her father's brain with a blinding flash and ten kilovolts of nervous energy, carrying the following message: *"My God, what a great ham shack that playhouse would make!"*

The doll buggy was quickly wheeled to an undesirable corner of the playhouse and the other playthings were stacked on top of it. Pa needed room for a ham transmitter, a large table on which to set his Patterson PR-10 receiver, a homemade condenser mike (which was built into a leatherbound Thermos bottle), and other items of radio equipment.

Every reader who was a ham during the thirties will probably remember that there were three classes of ham operator licenses in that era: the Class C or Conditional license, the Class B (corresponding to today's General Class license), and the Class A, equivalent to today's Advanced Class license.

About 1935, I secured an A license, which permitted me to conduct examinations sent out by mail by the FCC for the Conditional license. Among the many people whose examinations I supervised was a young man named Jim, who shortly thereafter enlisted in the Civilian Conservation Corps, a government, quasi-military-type agency created to provide employment for the myriads of young men who couldn't find jobs during the Great Depression. The enlistees wore khaki shirts and trousers for uniforms, and each camp was commanded by an army officer, usually a second lieutenant.

When the authorities at Jim's camp in Montana found that he possessed a radio operator's license, they immediately named him Camp Radio Officer and placed him in charge of communications. This indoor duty was, of course, much preferred over that assigned, for example, to the unskilled type of enlistees engaged in building the Timberline Lodge in the mountains east of Portland, Oregon, who had to work in the rain and mud, wrestling with the big rocks and huge timbers needed to build that impressive structure.

President Franklin Roosevelt, who never permitted his special presidential trains to travel more than thirty-five miles an hour, clickety-clacked it all the way from the White House to Portland to dedicate the Timberline Lodge project of the CCC when it was completed.

One Tuesday summer morning, Jim dashed in record time to the camp commander's office, bearing a message that he had just copied in Morse code on the receiver provided to the CCC by the government. After rendering a snappy salute, he excitedly handed the message to his boss. In essence, the message was a warning that Major General Jones would arrive on the forthcoming Friday to make a general inspection of the camp.

The commander and his troops had survived previous visits by second lieutenants, and even, on one occasion, by a traveling inspector who held the rank of First Lieutenant. An inspection by a Major General, however, was a horse of a different color. Even the words "Major General" in the text of the message struck terror into the heart of the camp commander each time he

Shown aboard the SS President Roosevelt *in Los Angeles harbor in 1970 are (L to R) Cal Smith W6BRD, retired long-time General Manager of KFAC, Los Angeles, the late Colonel Ben S. McGlashan W6GY, long-time owner of KGFJ, Los Angeles, and Colonel (Dr.) William C. Hess W6CK, author of this article. A few days later, the* Roosevelt *limped into Honolulu with a major boiler problem which required two weeks to repair. With free meals and free lodging provided aboard the ship, none of the passengers was heard to complain about being delayed for fourteen days in the lovely Hawaiian Islands on their voyage around the world. Today, the* Roosevelt *forlornly rusts away in Hong Kong harbor, awaiting a refurbishing which likely will never occur, and, perhaps, dreams of balmy evenings in exotic ports such as Papeete where, ablaze with lights from bow to stern, she awaits the return from shore of her affluent passengers.*

looked at it.

The world has never seen, before or since, such cleaning and sprucing-up activities as were carried on at that camp during the next three days in preparation for the visit by the two-star General. Scraps of paper, down to and including pinhead-sized ones, were hand picked from the entire campgrounds. Government trucks were used to haul 55 gallon barrels of water from a nearby river in an effort to "green up" the lawn in front of the commander's office. Each man's extra pair of khaki trousers was laundered, ironed to a razor sharp crease, and treated with so much starch that they were as stiff as a 1-by-10 board. They were then carefully hung away, to be worn on the big inspection day.

Friday came and went. No officer, not even a second lieutenant, showed up. Saturday, Sunday, and Monday passed with the same result.

Upon investigation, it developed that Jim, with his limited code-copying ability, had goofed. He had intercepted the subject message out of the air; it had not been addressed to the CCC camp at all, but rather to a huge army base a thousand miles away.

This incident had a happy ending, however, since after his CCC hitch Jim enlisted in the U.S. Navy. He spent twenty years as a radio operator and now can copy international Morse code at a high rate of speed—without error.

In previous issues of this magazine, I have related various incidents which occurred during the early history of radio station KGCX. That station was first operated as an unlicensed seven-and-one-half watter, near and in the tiny hamlet (population 25) of Vida, Montana, for a period of two years, beginning in 1924. In 1926, KGCX secured a license and continued to operate at Vida until 1929, when it was moved to nearby Wolf Point, Montana. Continuing its nomadic existence, it moved again in 1942 to Sidney, Montana, where it is now a very successful five-kilowatt operation, with auxiliary studios in Williston, North Dakota.

In addition to having been born in the smallest town in the United States ever to have a standard broadcast station and to being the second oldest station in Montana, KGCX also enjoys the distinction of being, no doubt, the only station ever to have operated with a completely nude crew.

One bitterly cold morning in 1935, KGCX's announcer and engineer overslept, having tarried too long the previous evening in one of the local bars.

Those readers old enough to remember how much *any* job (regardless of how lowly a job it was) was treasured during the Great Depression will understand completely the extreme alacrity with which KGCX's crew sprang into immediate action when they were awakened by station owner E.E. Krebsbach's telephone call with the terse message: *"Get on the air."*

As he had been sleeping nude in the warm basement of the KGCX building (the sleeping accommodations were part of their salaries), the engineer did not stop to put on any clothes, but ran upstairs, out the back door of the building, and through a snowbank, sans a stitch of clothing, to throw a switch on the antenna tower to the required position. He thus became the twentieth century's very first "streaker." The equally naked announcer started warming up the transmitter, a procedure which required that no less than eighteen switches be turned to the "on" position, some of which could be switched on immediately, while others required a delay of at least five minutes.

The engineer was working at KGCX without pay in order to have the "service time" on the back of his First Class operator's license endorsed by Mr. Krebsbach. He needed to prove that he had worked at a broadcast station during the five-year period for which his license was valid. Otherwise, he would have to take the very difficult First Class operator's exam all over again.

Since he had no funds whatsoever, one of the local restaurants gave him his meals "on the cuff," and he eventually repaid their trust. When he left Wolf Point, he went directly to Hollywood to be employed by the Columbia Broadcasting System. He is now retired after spending more than thirty years with CBS. He loves to reminisce about the old days in Wolf Point.

One summer afternoon in 1935, the controversial Judge Rutherford, who was a radio personality at that time, was speaking over leased telephone wires all the way from Seattle to Wolf Point. He was making a half-hour broadcast over KGCX. Mr. Krebsbach, who was also the gasoline-pump jockey at the Westland Oil Company service station just across the street from the KGCX transmitter building, was propped on a chair outside the service station listening to the Judge. Krebsbach, who was a man of firm political convictions, could stand no more of the Judge's views, and after fifteen minutes of listening, shouted across the street to his technician at the radio station: *"Take him off!"*

The engineer, painfully aware that interruption of the Judge's speech would result in a forfeiture of the $80 fee (an amount of money valued very highly during the dark days of 1935) tried without success to reason with Krebsbach, and the Judge was cut off the air without a word of explanation.

About the same time, a fortune-teller named "Stardust" performed on KGCX. She always came on the air with a burst of the song of the same name. Stardust and her husband must have found Wolf Point a bit dull compared to their home town of Chicago, but they were probably consoled by the flood of dollar bills that arrived in each day's mail as a result of the lady's broadcasts.

She always arrived at the studio an hour before her broadcast began to set up a "threshing" operation in the main studio. This operation, separating the wheat from the chaff in her daily mail, consisted of holding each letter up to a strong light to see if it contained a dollar bill or a check. Those that did were stacked on the studio piano to be answered on the air during the broadcast. The letters which obviously did not contain a remittance were immediately discarded (unopened) into a big wastebasket.

When KGCX's power was increased in 1936, all of its 250-Watt equipment was given to nearby hams or junked. This control board was built for the new kilowatt operation by Engineer Harold Klimpel, using only a hand-operated drill and a file. With the new arrangement, station technicians faced toward the south and were able to see into the studio to "ride gain" on the performances of The Rainbow Players, Montana Pete, Stardust, the fortune-teller, and other live broadcasts.

Stardust's career at Wolf Point came to an abrupt end when the Communications Commission suddenly prohibited fortune-telling on every U.S. radio station. She and other female fortune-tellers (such as "Margo") moved their operations to the notorious Mexican border stations. Dr. Brinkley's famous power stations, located just over the Mexican border from Del Rio, Texas, beamed enough power northward into the United States to light up the street lights in Minneapolis.

Mr. Krebsbach was a sports enthusiast. On those nights when a Wolf Point High School basketball game was to be broadcast, he would telephone whichever technician happened to be on duty that evening at the transmitter and give him the following instructions: *"Lock all the doors and go with 250."*

KGCX was supposed to operate only 100 Watts at night in order to minimize interference to other stations. Krebsbach's instructions to illegally use 250 Watts were obviously designed to obtain the maximum possible coverage for the basketball broadcast, and, of course, the precaution of locking all the doors was taken to prevent a federal radio inspector from entering the building unexpectedly.

During the thirties, a man named Roy Ayers campaigned for election as governor of Montana. KGCX heavily plugged Mr. Ayers' candidacy in eastern Montana. Mr. Ayers was elected, in part because of KGCX's support.

As a reward for his efforts, Mr. Krebsbach woke up one morning and found himself the new State Railroad Commissioner of Montana. The appointment made it necessary for the Krebsbach family to move to Helena, the state capital, for the duration of his term as a state official.

While Krebsbach was absent from Wolf Point, a man who was not very well liked by KGCX's staff was appointed manager of the station. This man was actually about 99% an advertising salesman for the station and 1% manager. All decisions of any importance were made by Mr. Krebsbach in Helena via telephone or mail.

One day, the substitute manager decided to repair one of the station's extension cords which was broken in half. He needed this cord to operate the Christmas tree lights which he was stringing around the studio. He carefully scraped all the insulation from the ends of the four wires of the broken cord. He then proceeded to *twist all four bare wires together* and taped the resulting splice neatly. The other KGCX employees present watched the entire procedure silently and offered

WESTLAND
RYAN

If those readers old enough to remember movie comedian Ben Turpin thought he was cross-eyed, they should have seen the pilot of the Westland Oil Company's corporate airplane, shown above. He could see with both eyes, but not with both eyes at the same time. This visual defect caused him to look at the tail of the airplane when landing, a procedure not looked upon with favor by his passengers. The author saw one of his crashes as it happened. This Ryan monoplane, serial number 23, was constructed in an old fish cannery in San Diego by the Ryan Aircraft Company and was flown for practice by Charles A. Lindbergh while he was awaiting delivery in San Diego of his "Spirit of St. Louis," an exact duplicate of the above airplane, bearing serial number 29. Westland's airplane, with the huge letters "KGCX" painted on the underside of the wing, was the object of a long search by the North Dakota Historical Society and finally was found in an old barn in North Dakota in 1957 with its wings sawed off. The Society paid the owner nearly as much for it as it had cost way back in 1927. U.S. Air Force personnel at Minot, North Dakota, restored it to absolutely new condition.

no suggestions.

The next step, of course, was to test the cord to see if the repairs had been properly done, so he plugged the proper end of the cord into the nearest wall outlet. After the minor explosion, fire, and smoke which resulted had subsided, he plaintively asked the other employees: *"What did I do wrong?"*

In the early days of radio in Los Angeles, my late friend, Ben McGlashan W6GY, was illegally broadcasting phonograph record music with his ham rig. He was a close friend of the radio inspector in charge of the Los Angeles office. The RI didn't want to prosecute his good friend for the crime of operating a radio station without a license, so he completed the application (now the application is as thick as a small book, but in those days it consisted of only one page) for a standard broadcast station. He typed in Ben's name, address, and the other details, and asked Ben to sign it. This would make McGlashan's broadcasting legal and solve a nasty problem for the RI by avoiding the prosecution of a friend.

However, McGlashan refused to sign the document, stating that he didn't want to own a regular radio station. The argument between him and the RI continued for at least fifteen minutes before Ben signed the application. Signing this document made McGlashan at least two million dollars in later years. Upon receipt of the license, he established KGFJ in the Odd Fellows Temple in Los Angeles, paying the Los Angeles City Dye Works two hundred dollars for the 50-Watt transmitter which was already operating in that building.

The late Freeman Lang, a prominent Los Angeles ham in the early days, could imitate the loud noise created by a rotary spark-gap transmitter in operation more realistically than the machine itself. He was also a good friend of McGlashan's and was always the master of ceremonies and radio announcer at the live broadcasts of the premieres of new movies held at various theaters in Hollywood. Mr. Lang, dressed in a tuxedo and high silk hat, would greet and interview the movie stars of that era who arrived in chauffeur-driven Lincolns, Duesenburgs, Minervas, Rolls Royces, or sixteen-cylinder Cadillac limousines or town cars. In the latter-type vehicles, rarely seen today, the chauffeur sat exposed to the weather while the VIP passenger was seated in a deluxe compartment at the rear of the automobile and communicated with the driver via telephone.

Around 1928, KGFJ experimented with television broadcasting, using, of course, the scanning-disc type of transmitting and receiving equipment. A friend in Santa Barbara, California, had one of the very few television receivers then in existence. Telephone communication was maintained with him during the experimental telecasts. When one of the KGFJ engineers asked the viewer in Santa Barbara, "What am I doing now?", and the correct answer, *"You're putting your hand into the picture,"* came back, successful telecasting over the ninety miles to Santa Barbara had been confirmed.

About the same year, Kenneth Ormiston, a radio engineer well known for his close association with the famous and flamboyant evangelist Aimee Semple McPherson, was staging closed-circuit television demonstrations at the famous Coconut Grove nightclub, located in the Ambassador Hotel in Los Angeles. Due to voltage surges in the electricity at the hotel, the two separate motors which he used to whirl the transmitting and receiving discs would not operate at the same speed, and the picture would fall "out of sync" and, at times be hardly recognizable.

Ormiston took drastic action to solve this problem. He chopped a hole through the wall which separated the transmitting and receiving equipment, ran a long steel shaft from one room to another, and operated this shaft with only *one* motor, giving the discs no alternative but to operate at the same speed.

Some years later, Lang moved to Honolulu, where he became a yacht broker. He and McGlashan maintained an autostart-teletype radio circuit between his office and McGlashan's posh home in Beverly Hills. This circuit was in operation twenty-four hours a day, so that each could leave the other a typed message whenever desired.

McGlashan once came within a hair's breadth of selling KGFJ for fifty thousand dollars. With pen in hand, he was ready to sign the bill of sale when a guardian angel must have hovered over his head and said: *"Don't do it."* This was extremely fortunate, as he retained this profitable station until 1964, when he was able to sell it for one and one-half million dollars.

The daily interest on $1,500,000.00 is a substantial sum, so as soon as he was handed a check for that amount in payment for his radio station, McGlashan hurried to his bank to deposit it so it would start drawing interest. A young teller gave him a receipt for the deposit. As he was leaving the bank, he suddenly reversed his direction and went back into the bank after noticing that the receipt was only for fifteen hundred dollars.

With its call letters now changed to KKTT, KGFJ was resold in 1979 for more than five million dollars.

A few weeks after the Japanese attack on Pearl Harbor, McGlashan enlisted in the Civil Air Patrol and flew his Stinson airplane to Brownsville, Texas, accompanied by 20th Century Fox's famous movie producer, Henry King, flying his Waco aircraft. Their planes, flying daily from Brownsville, with twenty-eight others under the Department of Defense, were used for anti-submarine patrol duty in the Gulf of Mexico, ranging as far south as Tampico, Mexico.

Each plane had a hundred-pound bomb suspended under its fuselage. The bomb release mechanism was triggered by the pilot, who jerked on a clothesline-type rope which ran to the cockpit of each airplane. These thirty planes sank two German submarines, scared hell out of a lot of others, and reported, via their two-way radios, the location of every enemy submarine which they spotted. The U.S. Navy followed up those leads with deadly results.

En route to Australia in 1972, I visited Freeman Lang KH6AX, who had a combination yacht broker's office and ham shack at a yacht harbor in Honolulu. He had a Morse telegraph sounder installed in a resonator box, which traditionally always had to have a Prince Albert tobacco can wedged behind it to amplify the clicking sound produced by the sounder. He had driven all over the island of Oahu trying to buy a can of that brand of tobacco, but without success. He finally wrote to the tobacco company on the mainland, telling them of his problem. They solved it by shipping him a whole case of empty Prince Albert cans at no charge.

He told me that he would buy me the best steak dinner available in Honolulu if I could "read" what he would send me on the sounder, which was connected to a Vibroplex. He added that he had maintained his ham shack at the yacht harbor for six years, and that no visitor to it had yet been able to read American Morse code well enough to decipher what he had sent to them.

I told him to go ahead and start sending, purposely failing to mention that I had been employed for a number of years as a railroad and Western Union telegrapher when I was a young man. To make it as difficult as possible for me to copy the sounder, he ripped off a long string of dots at about fifty words per minute. They translated into "Her Irish eyes cry cos she is so sorry," a statement which, in American Morse code, is composed entirely of dots without a single dash.

That evening at the nearby Ala Moana Hotel, I enjoyed the best steak dinner I have ever eaten, and KH6AX paid the bill.

The next day, my wife wanted to attend the "Hawaii Calls" program which is produced at a Honolulu restaurant. Not being particularly interested in the program being taped on an elevated stage before a large audience, I went to the long bank of audio equipment along one side of the stage to talk to the engineer in charge. We didn't exchange names but I did give him a glimpse of my First Phone card so that he would know that he was talking to someone who might be somewhat knowledgeable about what was going on.

Imagine my surprise when, after fifteen minutes of conversation, I discovered I was talking to Freeman Lang, Jr. Quite a coincidence to visit a well known ham and then accidentally meet his son the next day in a city with a population of a third of a million people.■

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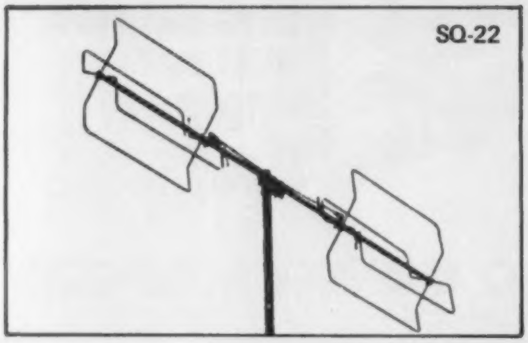

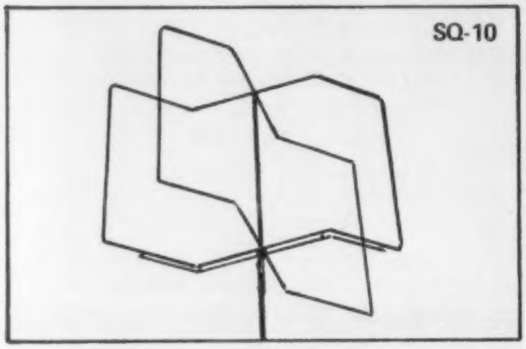

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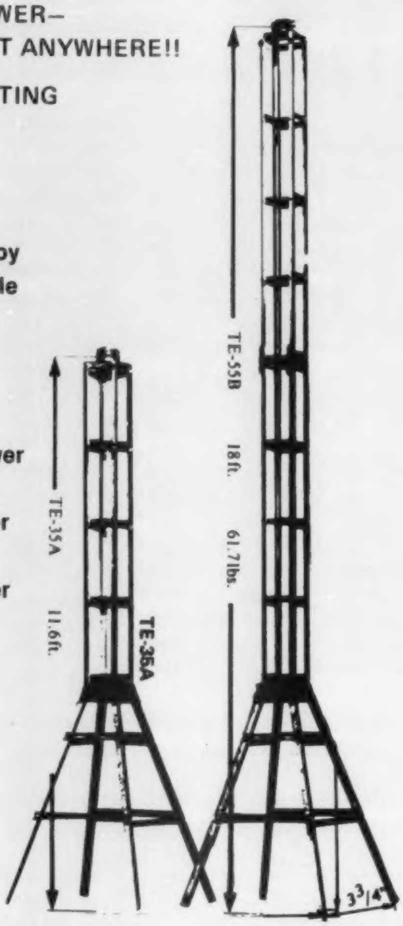

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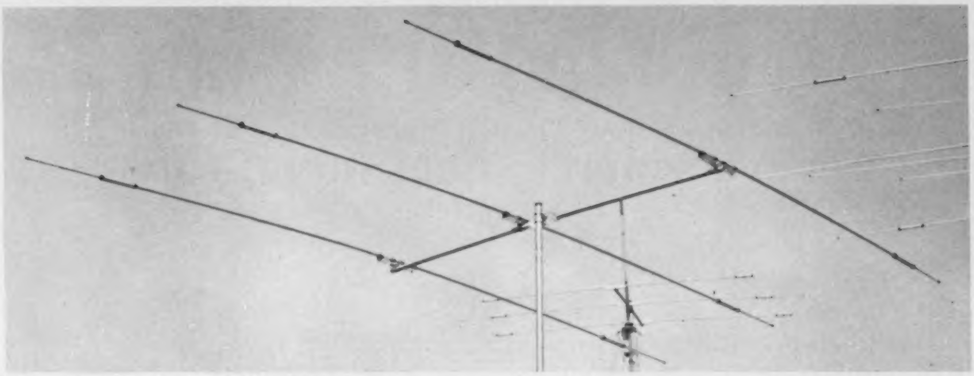

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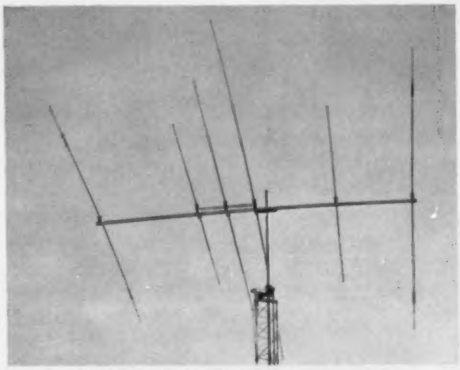

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3F37DX	14/21/28	7	3/5/5	2KW	BELOW 1.5	50 Ohm	34'11"	24'8"	17'5"	11.3 sq. ft.	226 lb.	2"	55 lb.

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Meet the Little Giant

—everyman's sheet-metal tool

The June, 1979, issue of *73* had an article by W0IHI on building custom-configured boxes. It was based upon the reasonable assumption that the average amateur does not have access to heavy-duty sheet-metal bending equipment. I recently came across a piece of equipment that made me see the situation from a different viewpoint, however, and this article is based on the use of this "light-duty" equipment that is within the reach of just about everyone.

The piece of gear I am referring to is the Little Giant Brake for forming and bending. Its name is fairly descriptive, and it really fills the bill for light-duty bending. It can make smooth bends to 90 degrees in metal up to 16 gauge (that's about .060"). It can handle material up to 18" wide, and the price is about $20.00. When a few hand tools that most of us already have are added, some really nice enclosures can be produced for a buck or two.

Mama is really a soft touch at times, so it took only some mild persuasion before I became the proud owner of this sheet-metal brake. Now, it doesn't make dutch bends, joggles, and other very exotic bends, but it can make a nice smooth bend that I have never been able to duplicate with a bending block and a hammer. The ability to make a nice crisp bend without waves or hammer marks can put your efforts in a class with commercial-quality cabinets.

I have bent a few boxes over the years, and, being one of the world's laziest hams, I have come up with a few shortcuts along the way. The Little Giant was the excuse I needed to try passing a few of them along, so here goes!

Most shortcuts start in the planning or design stage, and this is no exception. Your needs will dictate your design, and what goes inside will determine its size. If the unit inside is to be ac-powered, for example, the transformer will probably be placed near the back along with the fuse socket and power

Photo A. The brake clamps to the workbench and the brake bar is clamped down over the sheet metal, here bent to 45 degrees for a keyboard top.

cord. Controls will be at the front and the circuit board will occupy the major portion of the enclosure. (I am assuming that you will use either a PC board or perfboard for the majority of your circuits.) Once you know what's going inside, the shape and size is pretty well nailed down, but don't forget the front panel and controls. The front panel markings may very well demand the greatest amount of area, and this may dictate your final design and size.

I decided to try to illustrate my ideas by building an item that the shack has needed for a while: a keyboard enclosure. The shape is one that everyone will be familiar with, and I've found nothing commercially available that offers the room needed for expansion. It helps, of course, that its basic shape is easily perceived as the "clamshell."

I might point out that the brake will make bends slightly over 90 degrees, but we can tighten them up after we take them out of the brake. It's also worth remembering that every bend does not have to be 90 degrees. By opening or closing the bends, we can make some enclosures that look pretty exotic. You are limited only by your imagination when it comes to dressing up your enclosure.

Fig. 1 is a cross section of the tool itself showing the relationship of the sheet metal and the brake bar, but with clamps omitted for clarity. The left half of the tool (consisting of the brake bar and the fixed angle) and the sheet metal are held in place and do not move. The right half is movable and can force the metal up to about a 90 degree angle if you need it. It is possible to stop at any point between that flat and the full up position. Slight adjustments may be made in the angle after removing the metal from the brake.

Notice that in Fig. 2(a) the bends are a full 90 degrees, while in Fig. 2(b) one shallow bend has been added to slant the keyboard face both for better appearance and to aid in key identification if your skill in typing is more see than touch. The base also can be made to overlap the top by 1/8 to 1/4 inch, as in Fig. 2(c). This will provide a shadow effect that is very pleasing. Making the base a darker color than the top also adds to its appearance—it can sometimes make the difference between a box and an enclosure.

There's lots of truth in the old saying that "a coat of paint hides yesterday's mistakes." After painting, add a few well-placed lettering decals and your enclosure begins to look like a commercially-made unit.

Plan ahead, and put in enough room for the unexpected. Remember, the highest part inside doesn't always determine the size. Sometimes it's the front-panel lettering, but it could be the fan in back or a meter face that decides the finished size.

I like to start out with the front panel and place all of the parts in the positions they will occupy. One of the advantages of rolling your own is that you can change your mind at several points about layout or size without affecting your pocketbook. Another good point is that adding extra room costs little or nothing. This whole project cost me less than five dollars for material, with a lot left over.

After establishing size and shape, it's time to put plans on paper. One of the best shortcuts that I know of is to make the layout on paper that is glued directly to the metal to be worked with. This method offers several real advantages. It

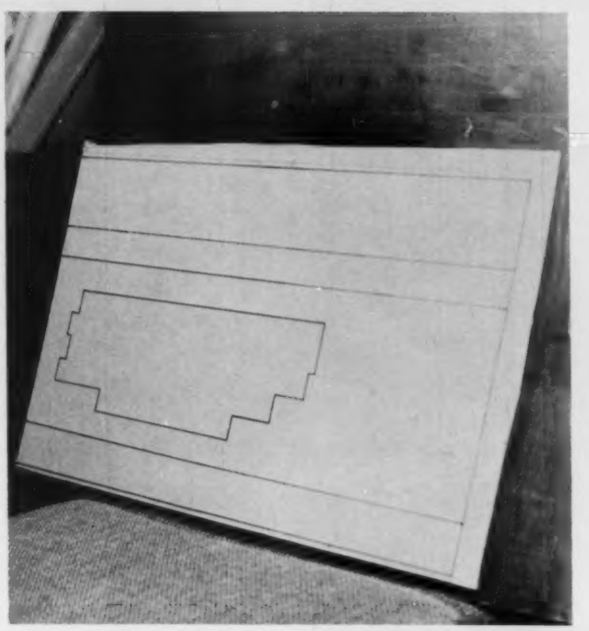


Photo B. The layout is glued to the sheet metal to guide cutting. It is glued flush left with the factory-straight left edge.

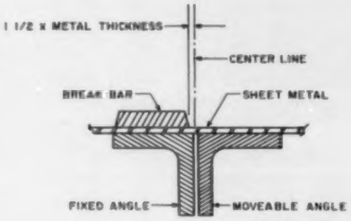


Fig. 1.

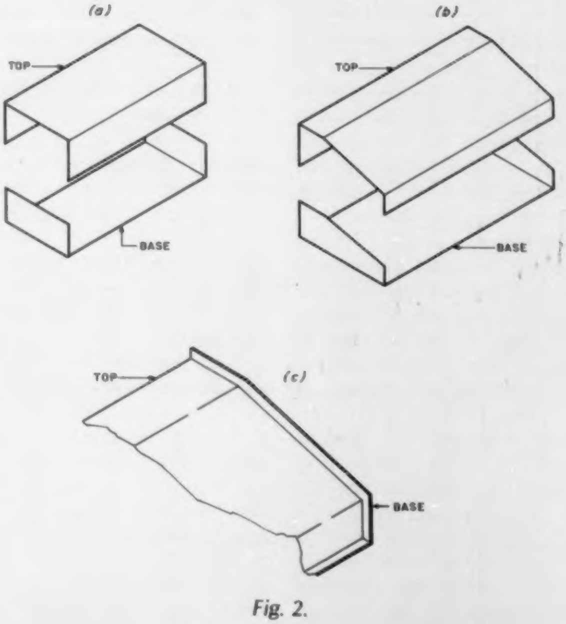


Fig. 2.

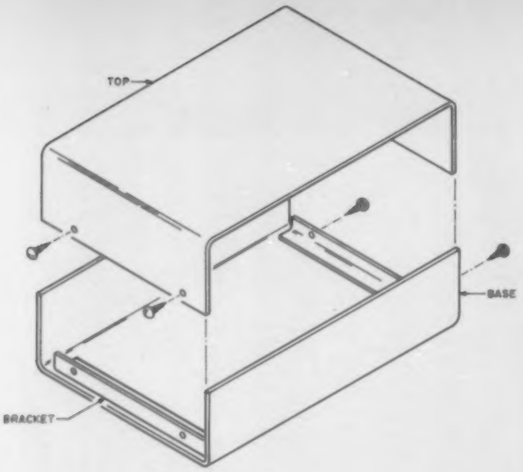


Fig. 3.

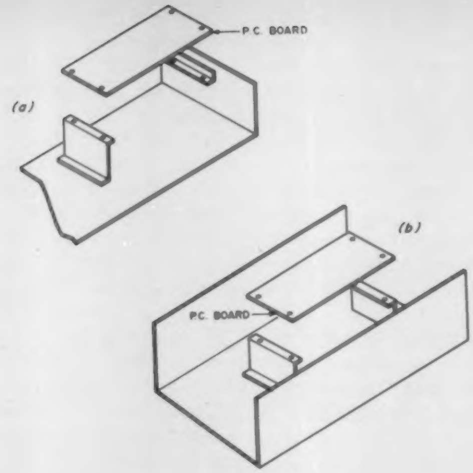


Fig. 4.

eliminates the errors that sometimes occur when transferring a layout from paper to metal; notes and how-to information can be added directly to the project so that they are always right in front of you; and, finally, when you are done, peeling the paper off reveals smooth, unblemished metal, free from scratches and nicks.

Let's assume that we have all of our hole centers, outlines, bend lines, and pertinent information on our layout. Gluing the paper to the metal takes only a few moments. (Rubber cement can be obtained anywhere, and a 4-oz. bottle will last through several projects.) Lay your paper layout on the metal with the outlines matching the edges of the metal where possible. This is assuming that you're working from a piece of metal with a couple of factory edges. If not, positioning should be done to save for the next job as much metal as possible.

Once in place, weight it down leaving one end loose. Spread the rubber cement on the metal after peeling back a corner. Cover the metal thoroughly, but not heavily, or you'll have lumps when you're done. Allow the paper to fall back on the metal, smooth it down by hand, and you are ready to glue the remainder of your layout. Remove the weights, apply cement to the rest of the metal, and smooth out the paper very carefully to prevent any wrinkles. Holding the far edge up with the opposite hand while working from the edge already glued is the best way to prevent it from sticking prematurely. Rubber cement acts like contact cement, so don't allow the paper to touch until it's in the right place; otherwise you may have to start over again. (If you have used heavy stock, like wrapping paper, you can peel it off without losing your layout, if you do goof.

At this point, it is a good idea to take all of your components, place them on the layout, and recheck clearances. It takes only a few minutes, and it is cheaper to catch a mistake here than after you start cutting and drilling.

We have one more design consideration to make, and that is how to hold the top and base together. The answer is fairly easy. Today, even airplanes are stuck together with glue, so we'll trust a tube of Super Glue to solve this problem. See Fig. 3. Cut small scraps of metal into strips about 2" by 1". Bend them into 1" by 1" by 1". Position these tabs on your cover, drill through top and angle at the same time, fasten together with sheet-metal screws, and you're ready to glue them to the base.

Put the top in place to make sure the tabs will position it correctly. Then remove the top, add one drop of adhesive to each tab, and place the top back into position. Press the tabs and base together for about 10 seconds, and you're done with that problem.

A couple of items worth remembering: Store the Super Glue in an upright position or it doesn't last long, and when using it, use one drop only at each position. (Any more and it doesn't work.) And it might be a good idea to have a bit of solvent on hand for "design changes"!

The same technique also can be used for mounting circuit boards, large capacitors, and even small transformers. No fancy measuring is required: Just bend up a couple of brackets as in Fig. 4, fasten them to the circuit board, position and glue. If you wish to mount a bulky item underneath the board, just make the brackets a little taller. You can even double stack your circuit boards by gluing brackets to existing brackets.

Fabrication is the next step. It is best to drill and cut every hole in the metal before bending. Centerpunch and drill every hole with an .060"-diameter bit before drilling larger holes. This prevents the larger bit from skipping out of a punch mark and marring the panel.

Large or irregularly-shaped holes can be cut with a nibbler or a saber saw. Clamp your metal to a thin piece of wood and saw the metal and the wood at the same time. This will keep the saw from ripping or bending the metal. A hole will be required for the saw blade or the nibbler. The nibbler will require a slightly larger hole than the saw blade.

It is easier to file away burrs before bending. One more check with the parts is worthwhile, and don't forget to double-check the direction of your bends. If everything fits and doesn't threaten to interfere after bending, we're ready to go.

For most enclosures to be built, bend allowance can be ignored. With the thickness of metal usually used, simple cabinets will come out OK without worrying too much about the stretching of the metal. If you start using metal more than .030" thick, things may start happening, however. The brake can make a completely square bend, but the metal may fracture and/or the brake could be damaged by the heavier metal.

It is best to use a rule of thumb of 1½ times the metal thickness. To get the bend line in the center of the bend, it must be positioned with some accuracy. First, leave the bend line back from the pivot line of the brake by one metal thickness and the brake bar back from the bend line by half the metal thickness. The bend that results is the tightest I can get without the possibility of problems. Bend the metal too tightly and the outside of the bend stretches, possibly fracturing, while the inside compresses, with possible damage to the brake. The problem is worse with thicker materials and is more noticeable in aluminum than in steel.

Photo C. The keyboard is placed in the base and positioned so that the top fits over it correctly; it then is glued down.

The brake is made of aluminum, a fairly hard alloy, but it *is* a light-duty tool, so play it safe. Baby it a little. The people who make it say it's OK to use it on aluminum or steel up to .060", but make sure you use mild steel. I normally confine my use of steel to .030" or thinner as a hedge against damaging my brake. (Softer metals such as brass, copper and aluminum should be OK up to .060"; just don't force them.)

Setting up the Little Giant is simple. It has mounting holes in each end bracket for permanent mounting, or it may be clamped to the bench with C clamps. I use the clamps as the bench space is at a premium, and Mama doesn't like holes in the furniture. Photo A shows the brake in some detail. The fixed section is held to the bench with the large clamps and the brake bar is used to hold the work in place with smaller clamps. The movable section should be positioned away from you so that you can see the work as you bend it. It's a good idea to cut and bend a few test pieces to get a feel for what happens to the metal and how much you'll actually have to fudge with your bend lines. It will be quite educational and decidedly cheaper than making mistakes later.

Aluminum is easy to work with as long as you don't try to use one of the harder alloys. I generally prefer 2024T3 or T4. The 6061 alloy is harder, but will do in a pinch. The harder alloys are more difficult to work with and generally are unnecessary for our kind of application. The dead soft material, available in sheets at hardware stores and lumber yards, is OK for small enclosures, but will not be rigid enough for larger ones. It requires the addition of "stringers" (small angles to add rigidity) glued to the backside of larger unsupported panels.

Only a few hand tools are necessary. The drill can be an el cheapo. It should handle a step bit up to ½" in soft materials. The nibbler requires about 3/8" diameter holes to get the head through. Don't use the step bits on harder materials with a ¼" drill, or your drill won't last too long. If you intend to go to flush screw heads, you'll need a countersink, a set of taps, and the appropriate drill bits. They can be purchased in a handy little plastic kit which has the taps, the correct bits to match the taps, and a tap handle. The pieces can be purchased individually at some savings. (You may elect to use panhead sheet-metal screws and eliminate them entirely.)

A rat-tail file, a triangular-shaped one, and a half-round file will do nicely for cleaning up burrs and holes. A small Shur-Form plane is nice for corners and ragged edges, but the files will do the job just as well. They're just a little more work.

Aviation shears are best for cutting out your basic blank. They are available in left cut, right cut, and straight cut. It would be nice to have them all, but I get along with one set of straight cut. Most of the work is straight lines, and it's only unhandy, not impossible, to cut curves with the straight cut shears.

To summarize: With slight variations in shape, slope, and size, you can develop some real eye-catching ideas. The top can be made in several pieces to add to the accessibility. The rear apron can be made as a separate piece and glued to the base so that the power cord, fuses, and permanently-mounted items do not have to come off with the cover. The rear panel of the cover can be shortened or notched to clear those items.

Another approach, where

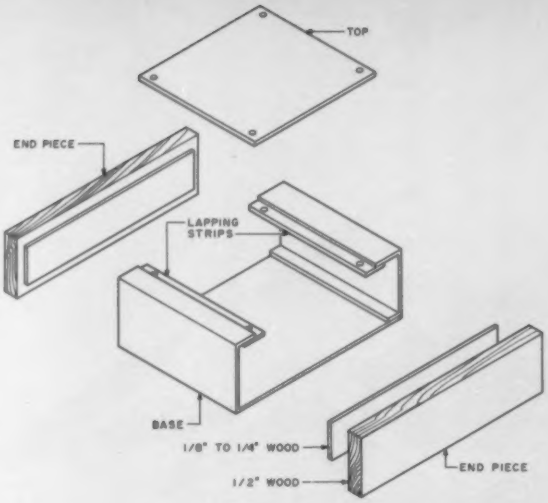


Fig. 5.

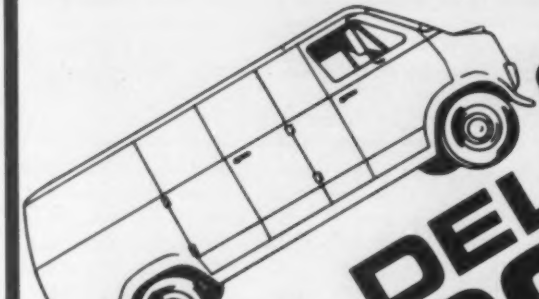
shielding is not a consideration, is to make the ends of wood. (See Fig. 5.) This allows us to make the front and rear as integral parts of the bottom. The top is then the removable piece. It can either overlap or be made as a flush joint. The flush joint is the more attractive of the two and only slightly more difficult to make. Strips are glued beneath the lips of both front and back panels. Set the top panel in place and align it to the front and back panels. When everything looks good, drill through both pieces and fasten together with sheet-metal screws. If you want to dress it up, this would be the place to use flat-head machine screws for a completely flush panel.

Don't skip painting the finished product. Many projects that look looked "ho-hum" before will look really nice when painted. If zinc chromate is available, use it as a base coat before adding color coats. It is easier to spray several light coats than risk runs from too much at one time. It is always disheartening to have a job almost done and then have to sand out a paint run or, even worse, have to strip it back to bare metal and start over. Runs are almost always a sign of impatience.

As for colors, a dark color for the bottom and a light color on top can be quite attractive. You might try one of the old favorites like black crinkle, and a light cream or blue on the top. The crinkle sprays just like any other paint, but wrinkles up in a random pattern as it dries.

Lettering is available from your local electronics store or art supply house in the form of decals or rub-on types. It would be a good idea to check prices at both places. You might be wise to buy some spray fixative from the art store to put a clear coat over the lettering to keep it from rubbing off.

Everyone runs short of ideas on occasion. If that should happen to you, try a little amateur espionage. Slip down to your local appliance or ham store and eyeball the other guy's solution to a similar problem. If you keep your cool, they'll never know that you are 007. ■



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On Ten FM

—home of the free, land of the brave

The word is out: 10-meter FM is definitely the place to be. Want to escape the "appliance operators" and the "twist two wires together, you're on the air" crowd? Well, up on 29.6 MHz you'll find a hearty breed, mostly experimenters and tinkerers who've converted, modified, and cajoled old commercial FM gear or ham-band equipment into frequency modulating on 10 meters. The combination of channelized operation (convenient), noise-free FM reception (easy on the ears), and roller-coaster 10-meter propagation (fun!) is most intriguing—it's really a mix of HF and VHF operation—you can sometimes work coast-to-coast with QRP, and there are FM repeaters to play with, too.

To give you a sneak preview of our plans, we're going to start with two inexpensive, readily-available circuit boards (the guts of an 11-meter CB transceiver and an FM scanner), mix thoroughly, and recycle into a compact, 6-Watt, channelized FM transceiver for 10 meters, with all the usual amenities such as noise-operated squelch, PTT, repeater offsets, and even a scanner. Note that this will not be your usual CB-to-10 conversion!

At this point, you may logically ask: Where are we going to get the raw material for our project? Fortunately, we won't have to scout around for the right CB transceiver to convert. By "right" I mean that type of CB transceiver which can be converted to 10 meters most easily, with the fewest changes and modifications. Typically, the 3-crystal PLL type of CB fits the bill.

Now, the first unit that we're going to use in this project consists of the main circuit board of CB transceivers that were made for Hy-Gain, Midland, and other manufacturers and are of the latest 3-crystal, PLL, 40-channel type. These little gems are top quality boards which measure only about 5" × 6" and come complete except for some external, easily added items such as volume and squelch pots. The boards can be converted easily to 29.6 MHz (or any other part of the 10-meter band) with only one crystal change. You'll get about 6 Watts of rf output from them in FM service and have full receiver sensitivity to boot. The CB boards are available from several sources by mail, at a low price. Specify the CB circuit board with a 40-channel switch. The second board, which we'll use for FM reception, will be described in a later section.

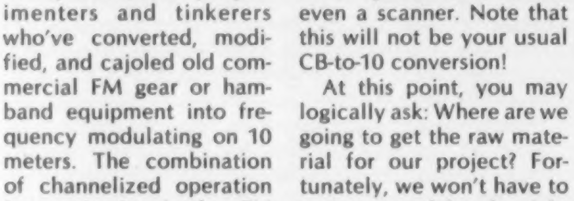


*Fig. 1. Improved FM modulator. *Choke value is not critical. 100 uH to 2.5 mH is suitable.*

Now, before you get the wrong idea about the complexity of this project, let me just say that I'm no electrical engineer—I probably couldn't design a circuit to save my life! What does appeal to the ham in me is to take already existing circuitry and equipment and blend them to get something new and different.

The first thing to do after ordering the CB circuit board is to send for the one crystal you'll need to get on 10 meters. There are, however, two questions that need to be answered: What frequencies are used for 10-meter FM operation and how does this relate to the crystal we'll need? There is a 10-meter FM band plan which is universally observed. The national simplex and calling frequency is at 29.60 MHz, with an alternate at 29.50 MHz. Repeater pairs are found at the following input/output frequencies: 29.52/29.62, .54/.64, .56/.66, and .58/.68 MHz.

The repeater output frequencies also are used sometimes for simplex operation on a non-interference basis—you'll always be able to tell if you're QRMing a repeater. Always avoid simplex operation on the repeater input frequencies for obvious reasons! At present, all 10-meter FM activity happens to be between 29.5 and 29.7 MHz, although narrowband (±5 kHz) simplex operation is allowed down to 29.0 MHz. In summary, then, what we'll need is at least 200 kHz of gap-free coverage, in 20-kHz steps, from 29.5 to 29.7 MHz.

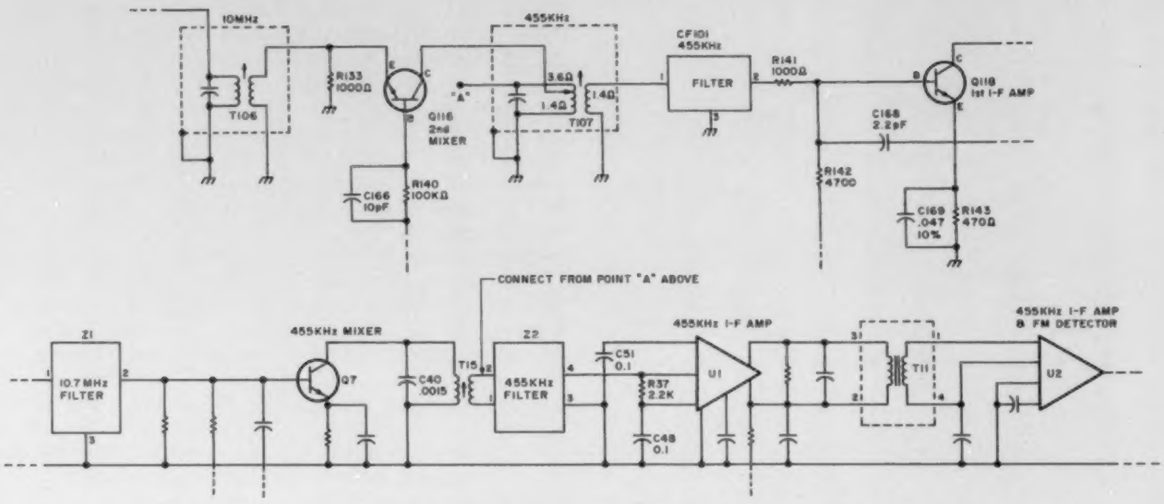


Fig. 2. Partial schematics, AM i-f strip (top) on CB board, and FM i-f strip on scanner board.

Since the 10-meter FM portion lies at the upper edge of the band, I wanted channel 40 to come out at 29.7 MHz to avoid wasting any channels. This ensures continuous coverage, in 10-kHz steps, down to 29.5 MHz, and channel 1 takes you all the way down to 29.26 MHz for any future simplex FM activity. Also, with this scheme, the channel frequencies are easy to figure out. Just take the channel number, add 30 and hang 29. in front of it. For example, channel 30: 30 + 30 = 60; placing 29. in front gives 29.60 MHz.

Some Improvements

A previously published article covers the theory of operation of these CB boards, selection of crystal frequency, and details of setting them up for FM operation.[1] In this article, I will describe a different approach to the conversion, particularly on the reception side, but you should refer to Reference 1 for the basic conversion information.

Firstly, crystal X101, originally 11.8066 MHz, should be changed to 12.5716 MHz to get channel 40 onto 29.7 MHz. Secondly, to improve the audio punch on transmit, I've modified the FM modulator circuit a bit and added a full-wave audio clipper and low-pass filter. See Fig. 1. The combination of two stacks of silicon diode clippers provided the right amount of clipping for my particular microphone/CB board combination, i.e., about 2 × 0.7 volts = 1.4-volt clipping level.

One stack of germanium diodes and one stack of silicon diodes would give a 0.3 V + 0.7 V = 1.0-volt clipping level, for example. The combination of R1, the deviation pot, and the 0.1-uF capacitor comprises a low-pass filter to eliminate some of the crud which is generated by the clipping. The clipper provides a very worthwhile improvement in average deviation level (analogous to average modulation percentage on AM). Also, I've used a choke instead of a resistor to feed audio to the varicap circuit to improve audio quality. Finally, for slightly more rf output, try jumping R131 (10 Ohms) on the CB board.

FM Reception: Plain or Fancy?

The previously referenced article describes an IC limiter/FM detector/noise-operated squelch circuit for FM reception in conjunction with the CB board. However, I chose a different route to FM reception. My path started many months ago at a hamfest where Science Workshop was running a display. One of their sale items was an E. F. Johnson Mono-Scan UHF-FM scanning monitor receiver board. These compact units come complete with front panel and all controls and lack only a speaker and case. They can be run on 12 V dc or 117 V ac if you add a step-down transformer, as the rectifier, filter, and regulator are built in. Its double-conversion FM i-f strip uses two filters and two ICs for hard-limiting and quadrature FM detection; the squelch circuit is noise-operated.

The Mono-Scan can run through eight UHF frequencies (it requires one crystal per frequency) and has the usual scan skip/lock-out switching arrangement and channel light indicators. The units measure about 6″ × 7″ × 2″; their frequency coverage in stock form is intended for the 450-MHz commercial FM band, but they can cover the 70-cm amateur FM frequencies, too. The scanner boards also are available by mail at very reasonable prices.[2]

What interested me even more, though, was the fact that the scanner's i-f frequencies, 10.7 MHz and 455 kHz, matched those of the CB board. This pointed toward the possiblity of mating the i-f strips of the two boards to provide FM reception: The CB board would be the tunable front end and first i-f amplifier and the scanner would provide further amplification, limiting, and FM detection. I felt that this combination would yield superior FM reception due to the use of proper i-f bandwidths in the receiver.

Briefly, a narrowband, ±5-kHz-deviated FM signal actually turns out to be about 13.6 kHz wide, because with FM signals you must consider at least the first *two* sets of sidebands. Contrast this with an AM signal where only one set of sidebands is even generated. This means that for optimum deviation acceptance of fully-modulated FM signals, least audio distortion, and greatest noise suppression during full deviation, your FM receiver

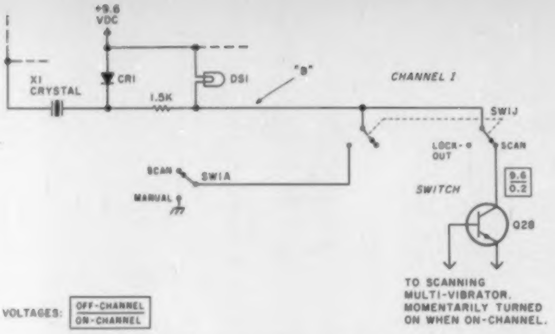


Fig. 3. One of the eight scanner board circuits.

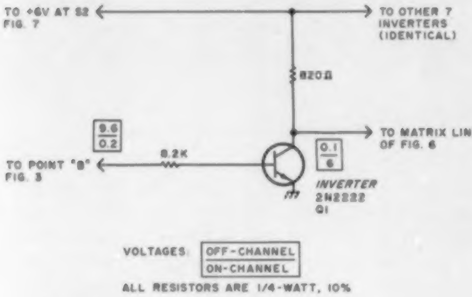


Fig. 4. One of the eight inverter circuits.

must be at least 13.6 kHz wide. The scanner has such an FM filter on board, so let's try it!

The next question is, of course, will it work? It was easy to find out—all it took was a short piece of coaxial cable running from one board to the other. Refer to Fig. 2 for partial schematics of the AM and FM i-f strips. For various reasons, I chose to "cross over" the signal at 455 kHz rather than 10.7 MHz. Incidentally, this sort of hybrid match will work with other receiver/i-f strip combinations as well, as long as they have an i-f frequency in common.[3]

Getting the scanner board up and running is no problem—you'll need only a speaker and 12 V dc. A schematic and parts location diagram is provided with each scanner. Plus 12 V dc from pin 20 on the CB board goes to the plus side of capacitor C79, a 1000-uF unit. The negative power lead can be applied anywhere along the underside rear edge of the board. The speaker goes from the negative side of capacitor C66, a 330-uF unit on the left side of the board, to the power supply negative lead. To temporarily interface the CB and scanner boards, simply run the inner conductor of a short piece of coaxial cable from terminal 1 of CF101 on the CB board to the high side of the secondary of transformer T15 on the scanner board. Ground the shield at both ends. In this way, you can temporarily run both the AM and FM i-f strips simultaneously to make sure that everything is perking OK. You will note that this combination is quite hot in the sensitivity department—the FM i-f strip has enough gain to limit on noise alone.

After you are satisfied that all is well, you may make a permanent connection as follows: To disable the AM i-f strip (we want all of the signal to go to the FM i-f strip), remove AM i-f filter CF101 from the CB board and move the coax connection to the high side of the primary of transformer T107 on the CB board. This is Point "A" as indicated on the schematic in Fig. 2 and was selected as providing the best impedance match to the FM i-f filter, Z2, on the scanner board. Cut the foil from the high side of the secondary of T15 to filter Z2 and remove the 11.186-MHz crystal, Y1, from the scanner board.

Receiver alignment isn't much different than before: Using a weak (noisy) signal, touch up L112, T106, and T107 on the CB board for maximum quieting and ditto for T111 on the scanner board. T112, the FM detector adjustment, should be set for maximum audio recovery consistent with minimum distortion. Keep the alignment signal as small as possible during adjustments. You can expect better than 0.5-uV quieting sensitivity and a steep quieting curve if you do a careful job on the alignment—spend some extra time here; it's worth it.

A few items will finish 'er up: You can increase the noise-operated squelch sensitivity by changing R66 (1k Ohm) to 150 Ohms and R65 (6.8k Ohms) to 620 Ohms.

Scan 10-Meter FM, Too? Yup!

All those blinking lights on the scanner intrigued me greatly—wouldn't it be neat to have a scanning FM receiver on 10 meters? By being able to listen to both simplex frequencies and all of the repeater outputs, it would be easy to spot band openings as well as to keep tabs on the gang. Also, it might be possible to select transmit frequencies from the scanner front panel with the push of a switch.

A look at the scanner schematic revealed that a multivibrator circuit drove a string of eight transistors, one for each channel, one at a time in sequence, to provide a stepping action from one channel to the next. Each of these "switching" transistors is set up to provide a ground for both the appropriate crystal and channel indicator light when momentarily "addressed" by the multivibrator. The presence of a signal unsquelches the receiver and stops the scanning action; when the squelch closes, scanning action resumes.

Putting a voltmeter across one of the transistor collectors showed that the voltage swung from +9.6 V dc when off channel to +0.2 V dc when on channel—the latter corresponds to a grounded condition, being close enough to zero volts. Any possibilities of interfacing the scanning circuit with the CB board would depend on the logic and voltage levels needed by the CB board's PLL frequency synthesizer circuit for channel selection; i.e., what polarity and voltage levels would be necessary?

Going back to the CB board schematic, the following information was gleaned: The PLL divider circuits require about +5 V dc on each divider gate to become activated (turned on) and less than +0.2 V dc (ground) or an open line to be deactivated (turned off). Looking back at the last paragraph, it's clear that not only are the logic levels backwards on the two boards, but the voltage levels are wrong, too. Therefore, some sort of interface circuit would have to be developed that would: a) invert the logic levels, and b) drop the voltages from 9.6 V dc to 5 V dc.

Fig. 3 shows just one of the scanner's eight identical switching circuits;

			2^8	$2^5+2^6+2^7$	2^4	2^3	2^2	2^1	2^0	**Gate Values**
F(MHz)	**Ch #**	**N**	÷256	÷224	÷16	÷8	÷4	÷2	÷1	
29.50	20	248		X	X	X				
.52	22	250		X	X	X		X		
.54	24	252		X	X	X	X			
.56	26	254		X	X	X	X	X		
.58	28	256	X							
.60	30	258	X					X		
.62	32	260	X				X			
.64	34	262	X				X	X		
.66	36	264	X			X				
.68	38	266	X			X		X		
.70	40	268	X			X	X			
			7	8,9,&10	11	12	13	14	15	**PLL pin numbers**

Notes:

1. "X" means divider gate energized by application of +5 V dc.
2. ÷1 gate not activated on even-numbered channels.
3. Gates for 2^5, 2^6, and 2^7 are tied together on circuit board to function as single ÷224 gate.

Table 1. PLL divider gate combinations.

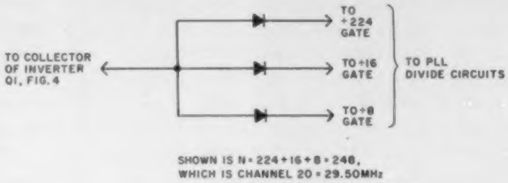

TO ÷224 GATE
TO COLLECTOR OF INVERTER Q1, FIG. 4
TO÷16 GATE
TO PLL DIVIDE CIRCUITS
TO÷8 GATE
SHOWN IS N=224+16+8=248, WHICH IS CHANNEL 20 = 29.50MHz

Fig. 5. Basic diode matrix.

each one operates as a grounding switch when addressed, its collector swinging from 9.6 to 0.2 V dc. Fig. 4 is an inverter circuit which was figured out after some head scratching and pencil biting. This simple NPN transistor circuit has its base circuit hooked to the collector of the scanning switch transistor at point B of Fig. 3. As the scan transistor goes from 9.6 V (cut off) to 0.2 V (conduction), our inverter does just the opposite, swinging from 0.1 V (conduction) to 6 V (cut off), which, as we'll see later, is close enough to what the PLL needs. I used inexpensive 2N2222 transistors for the inverters, of which we'll need eight, one for each scan channel. Switch SW1A on the scanner board (Fig. 3) is the scan skip/lock-out for the first scanner channel, and SW1J is the Master Scan/Manual switch.

The next question is how we propose to get these now proper voltage and logic levels to the right combination of PLL divider gates on the CB board to select the channels we want. Like most digital circuits, the divide-by-N circuit in the PLL, which gives us different frequencies by varying the value of N, works using binary instead of decimal numbers. In other words, it operates using the number "2" as a base and powers thereof. For example, $2^0=1$, $2^1=2$, $2^2=4$, $2^3=8$, $2^4=16$, $2^5=32$, $2^6=64$, $2^7=128$, and $2^8=256$.

In order to select and divide by any particular value of N to get a certain frequency out of our PLL, we've got to energize the right combination of divider gates. For instance, if it takes N=224 (channel 1 in our scheme) to give 29.26 MHz, then we would activate (by applying 5 V dc) divider gates 2^5, 2^6, and 2^7 because their values of 32 + 64 + 128 = 224 = N; the other divider lines would remain at ground, therefore deactivated.

In Table 1, the actual frequencies, channel numbers, values of N, and combinations of active divider gates are shown for frequencies from 29.5 to 29.7 MHz, in 20-kHz steps. Note that one divider line, the $2^0=1$, is never activated because it subtracts 10 kHz and all of our channels are on even frequencies. To digress just a bit, what the manual 40-channel selector switch does is select the right combination of divider gates for each channel to give the desired frequency. In it are seven SPST switches, one for each gate, actuated by a programmed mechanical cam; the correct combination of switches is selected by the cams as the switch shaft is turned to a particular channel. Essentially, the switch is a mechanical binary-coded decimal counter.

What we want is to have the scanner select the channels electronically, letting it do the knob twisting for us. As each scanner channel is addressed, a corresponding inverter transistor provides the necessary 6 V dc, which we will apply to the right combination of divider gates through a diode matrix. The matrix selects the right combination of gates for each particular frequency and the diodes provide isolation between the gates.

Suppose, for example, that we wish to select 29.50 MHz as the first scanned channel. Table 1 shows that the ÷224, ÷16, and ÷8 gates must be activated, to give a total N value of 248, by the first inverter via a matrix. Note that the ÷224 gate is actually made up of the ÷32, ÷64, and ÷128 gates all tied together to act as a single ÷224 gate. Fig. 5 shows us the arrangement that the first inverter and diode matrix will use to give us 29.5 MHz. A second scanned frequency would require that a different combination of gates be activated, which would be done by a second inverter circuit (connected to point B of the scanner's second channel switching transistor) and diode matrix, and so on, for all eight scanner channels.

The full diode-matrix circuit can be found in Fig. 6. I built the matrix on a small perforated board (0.042" holes) along with the eight inverter transistors. A simple 6-V dc zener-diode regulator also was included to supply the inverters—see Fig. 7. A voltage level of 6 V dc was chosen to overcome a 0.7-volt drop through the diode matrix, giving about 5.3 V at the PLL divider gates. The switch, S2, in Fig. 7 selects either the scanning mode or manual channel selection via the 40-channel switch by routing 6 V dc to either the scan inverters or the manual selector switch. The matrix shown in Fig. 6 is wired to scan channels I through VIII as 29.50, .56, .58, .60, .62, .64, .66, and .68 MHz; any other frequencies can be programmed in by consulting Table 1 and rewiring the matrix accordingly.

It works like a charm.

Repeater Operation, Too?

Yes, Virginia, there are

10-meter FM repeaters, but no, they don't sound quite like the 2-meter machines! In my location (northern New Jersey), there are two 10-meter machines within ground-wave range plus many other machines heard via skip. Most of the repeaters are open machines, but some may require PL or tone-burst when the band is noisy, to prevent various non-signals from keying them up. They are all on in-low/out-high, 100-kHz splits.

My original "fast-fingers" method of working through the repeaters was to flip the manual channel selector rapidly from the input to the output frequencies on transmit and receive. Needless to say, this led to some strange and disjointed QSOs! A method had to be found of dropping the transmit frequency 100 kHz below the receive frequency when in the repeat mode.

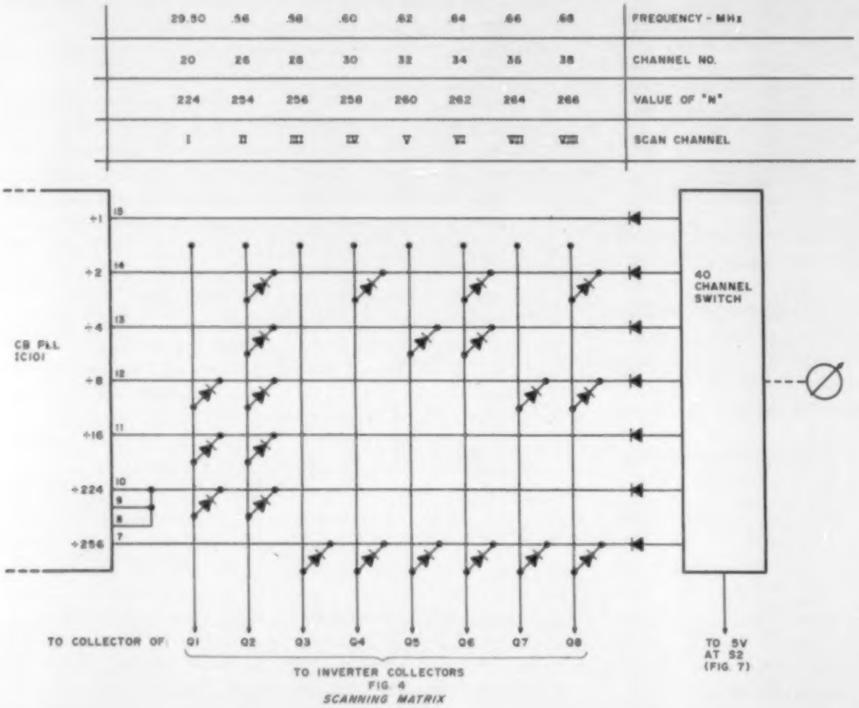
There are two obvious possibilities for doing this: Either shift the transmit-offset oscillator, Q109, on transmit or else program the PLL to do the same. The first approach looks the easiest—you would need only a small SPDT reed relay to switch between the existing 10.695-MHz transmit-offset crystal and a new crystal at 10.795 MHz for repeater operation. The new crystal has to be higher in frequency to give us a downward shift because of the mixing scheme in the transmit mode. You would have to be careful of stray capacitance, though, so as not to pull the crystal frequency off. Also, this arrangement does not allow "reverse-split" repeater operation.

The second approach is even simpler. Set your scanner in its manual mode to the repeater output frequency and set the 40-channel manual selector to the repeater input frequency. Then wire up an SPDT reed relay to toggle 6 V dc between the scan inverter circuit on receive and the 40-channel switch on transmit. The plus side of the relay coil can go to the +12 V dc line on the CB board and the negative side can go, via S4, the simplex/repeat switch, to pin 13 on the CB board, which is brought to ground on transmit by the PTT switch. To provide reverse-split capability, simply wire a DPDT switch to interchange the 6 V dc lines per S3. See Fig. 8(a) for details.

I took this concept one step further to provide completely automatic repeater-offset operation, albeit with a more complex circuit, as shown in Fig. 8(b). An extra four inverter circuits, identical to the first eight, and a 4 × 6 diode matrix were constructed. The base circuits of each of the four new inverters were connected to each of the scanner transistor channels V through VIII in the same fashion as the original eight inverters; these channels are set on the repeater output frequencies, i.e., 29.62 to 29.68 MHz. The additional 4 × 6 diode matrix was wired to select the corresponding repeater input frequencies, i.e., 29.52 to 29.58 MHz, and connected, in parallel with the original 8 × 6 diode matrix, to each of the PLL gates. Now, the same SPDT reed relay is used to toggle 6 V dc between the original set of inverters on receive and the new set of inverters on transmit, thus selecting a repeater output frequency on receive and the corresponding repeater input frequency on transmit.

For example, with the matrix shown in Fig. 6, scan channel VI, the second repeater output frequency, is set for 29.64 MHz. The corresponding repeater input frequency would be 100 kHz below, at 29.54 MHz, so the second line of the new 4 × 6 matrix should be wired up to provide that frequency from the PLL; Table 1 tells you which PLL lines have to be activated for this frequency. This circuit is "goof-proof," too—if you accidentally select a non-repeater output frequency on the scanner and try transmitting while in the repeat mode, the transmitter will simply not key up.

As you can imagine, some rather interesting things can happen on these machines. For instance, how would a G4 to KV4 QSO via a WR2 grab you? Or how about two QSL cards for just one contact, such as when I had a QSO with a KL7, first via a WR6 machine and then, immediately following, a direct contact on the same frequency, with both of us running reverse split. I figure that the single QSO counted for two states worked! Of course, working from New Jersey to



29.50	.56	.58	.60	.62	.64	.66	.68	FREQUENCY - MHz
20	26	28	30	32	34	36	38	CHANNEL NO.
224	254	256	258	260	262	264	266	VALUE OF "N"
I	II	III	IV	V	VI	VII	VIII	SCAN CHANNEL

Fig. 6. Notes: All diodes are 1N914/1N4148. Seven diodes shown from 40-channel switch must be used to provide isolation from any matrix used. Pins 8, 9, and 10 of PLL are tied together to act as a single ÷224 gate.

Maryland via a repeater in Colorado might be called the hard way, but you do meet people that you'd never otherwise hear on 10 meters.

Deluxing It

To provide continuous subaudible tone encoding (PL) as well as tone-burst capability, the IC circuits in Reference 4 look like a good bet. In fact, at the moment I'm installing just that circuit in my 10-meter FM rig. The Exar chip is not cheap, but it's so simple when everything is in one IC package. A good place to inject the tone encoder's output into the FM modulator circuit, Fig. 1, would be between the 0.01-uF capacitor and the choke, L1. Since the PL tone is rather low in frequency, about 100 Hz, your coupling capacitor from the tone encoder would have to be larger in value, say about 0.05 uF. As of this writing, two machines in California require PL (107.2 Hz) and one machine in the state of Washington requires an 1800-Hz burst. However, you may find that on weekends the machines may be run on an open basis, depending on band conditions and QRN.

Since the scanner provides push-button selection of all necessary 10-meter FM frequencies, a digital readout is admittedly a frill. However, I'm presently working on paper to find a suitable circuit. The PLL divider lines are not set up on purely a sequential binary basis; i.e., you'll note from Table 1 that at 29.58, the ÷224 line is shut off, the ÷256 line is picked up, and the 2^1 through 2^4 lines start their count from zero again. And, of course, the number 224 is not your usual binary number.

What all this means is a decoding headache. My latest thought, therefore, is to use a programmable read-only memory (PROM) such as an 8223 or 74188. This type of PROM is easily programmable in the field without a fancy and complex programmer. It appears that only one 8223 would be needed to decode the PLL's line states to pure BCD form, in which case two 7448 BCD decoder/7-segment LED display drivers could drive a pair of common-cathode LED displays to read out the tens and hundreds of kHz of frequency, e.g., .62. Frankly, I don't have the digital expertise to put it all together without a lot of sweat, so I'd enjoy hearing from anyone who's done it.

One way to increase the output of these rigs is to run 'em through an amplifier. Since we're using FM, a Class C amplifier is fine because you don't need a "linear" amplifier for FM service. Incidentally, there are still more solid-state CB "afterburners" floating around. Some of these little monsters will put out 125 Watts dc, but I wouldn't say much about their linearity. Although supposedly linear, I wouldn't use them for anything but FM.

A word about operating practices seems in order here. Due to the delicate nature of FM (wide receiver i-fs), it is important that non-FM operation be kept to a minimum in the 29.5-to-29.7-MHz segment. SSB sigs really "tear up" an FM receiver. Also, due to the large number of users of 29.6 MHz, courtesy is an absolute must. Listen first to avoid chaos! QSY upward from 29.6 for ragchews and avoid simplex operation on repeater inputs.

All letters accompanied by an SASE will be answered. ■

References

1. "CB-to-10 FM," K1DCS, N1XN, W1WRO/N2XN, *73 Magazine*, January, 1980.
2. The E. F. Johnson "Mono-Scan" UHF-FM Scanner boards are available for $9.95 plus $1.00 postage from: Science Workshop, PO Box 393, Bethpage NY 11714. Specify Catalog No. 103B, "UHF Scanner Chassis, used."
3. "Providing a Tunable VHF-FM Receiver," *Hints & Kinks*, ARRL, 1978, p. 108.
4. "Experimenting With Tones," George R. Allen W2FPP, *73 Magazine*, February, 1979.

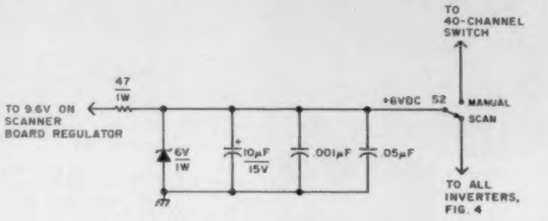

TO 40-CHANNEL SWITCH
47 / 1W
TO 9.6V ON SCANNER BOARD REGULATOR
+6VDC
S2
MANUAL
SCAN
6V / 1W
10μF / 15V
.001μF
.05μF
TO ALL INVERTERS, FIG. 4

Fig. 7. +6 V dc regulator.

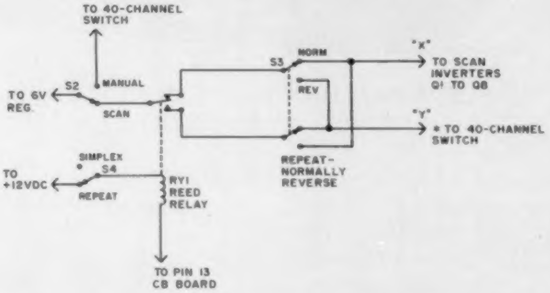

TO 40-CHANNEL SWITCH
S2
MANUAL
TO 6V REG.
SCAN
S3
NORM
REV
"X"
TO SCAN INVERTERS Q1 TO Q8
"Y"
* TO 40-CHANNEL SWITCH
REPEAT-NORMALLY REVERSE
SIMPLEX
S4
TO +12VDC
REPEAT
RY1 REED RELAY
TO PIN 13 CB BOARD

Fig. 8(a). Repeater offset circuit. *When fully-automatic repeater offset circuit is used, this line goes to the extra four scan inverters and 4 × 6 diode matrix instead (See Fig. 8(b).).

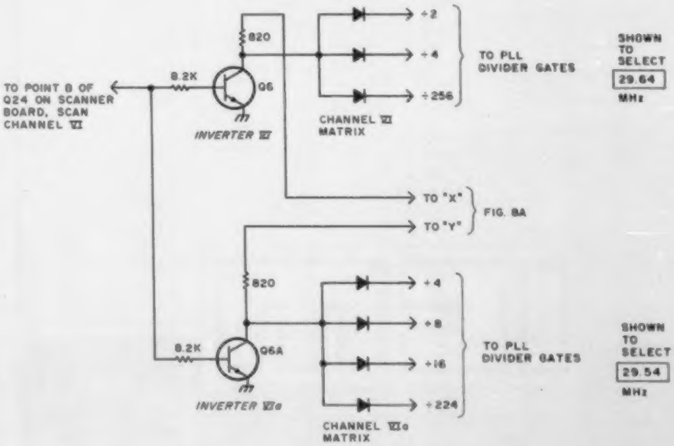

820
8.2K
Q6
TO POINT B OF Q24 ON SCANNER BOARD, SCAN CHANNEL VI
INVERTER VI
÷2
÷4
÷256
CHANNEL VI MATRIX
TO PLL DIVIDER GATES
SHOWN TO SELECT
29.64
MHz
TO "X"
TO "Y"
FIG. 8A
820
8.2K
Q6A
INVERTER VIa
÷4
÷8
÷16
÷224
CHANNEL VIa MATRIX
TO PLL DIVIDER GATES
SHOWN TO SELECT
29.54
MHz

Fig. 8(b). Repeater offset circuit (one of four).

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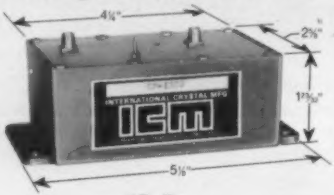

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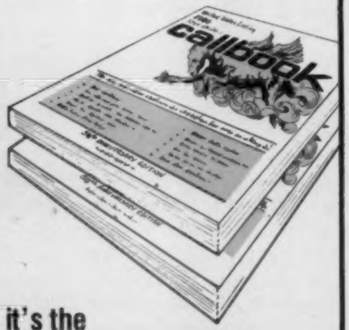

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The Rains of Morvi

— duty in disaster for Indian hams

Editor's Note: The author is president of the Federation of Amateur Radio Societies of India.

Disaster struck Morvi on the 11th of August in the afternoon. Due to incessant and unusually heavy rains, the earthen Macchu Dam No. 2 burst from both sides of the spillway and engulfed the entire city of 75,000 persons. A wave 7′ or 8′ high caused the initial damage which devastated 80% of the buildings and left an estimated 10,000 persons dead.

The water continued to rise to a maximum of 15 feet, and many were saved only by going to the third floors of buildings, where such existed. There is no dearth of stories of terror and heroism. After the flood waters receded, the streets and houses were under 14 feet of mud.

Communications and power supplies were completely wiped out at one stroke. Such was the devastation that word could not go out, and small towns within 10 or 15 km did not know of the tragedy for 24 hours. When word finally trickled out, the Home Guards were the first to reach the city, from Rajkot, 70 km away. They swung into action immediately, and their heroic efforts in extricating wounded persons from the debris, disposing of dead bodies and cattle, and organizing relief is a story by itself.

The Federation of Amateur Radio Societies held an emergency meeting along with the Radio and Electronics Society of India and noted that while relief of all sorts was being organized on a large scale by government and private agencies, there was bound to be need of communications.

Within two or three days, volunteers were mobilized, equipment collected, and antennas made. As we had no preparedness for such emergencies, we grabbed whatever equipment was available, namely the Atlas transceivers of Ishwer VU2AE and of Dr. Kirti Doshi, as well as my own FM and SSB 2-meter transceivers. Later, we added the FT-100 of Rayu VU2YY, Ahmedabad, and the KW-2000 of Dasan VU2AID at Rajkot.

The first team, consisting of Vasant VU2RX, Jimmy VU2IJ, and Chris VU2KIT, left for Rajkot (via Jamnagar, as no direct flight was available). They arrived at the Galaxy Hotel and, while discussions were going on as to where and how

Photo A. The floodplain was swept bare, and part of the bridge destroyed, by the force of the water.

Photo B. The author (right) in front of the operations tent with (L to R) Chris VU2KIT, Jimmy VU2IJ, District Commandant Ushakant Mankad, and Jai VU2ED.

Photo C. In the tent, Chris VU2KIT uses the Atlas transceiver and IC-20 2m FM.

Photo D. The mobile jeep with operators and Home Guards. Author Saad Ali VU2ST is at upper left.

to operate, a station was set up in the hotel room itself. Operating as VU2RES, contacts were made with Bombay and others. Here they were joined by Deepak VU2DCD and Jivanbhai VU2JF.

Deepak VU2DCD, a local ham, immediately contacted the Home Guards and brought the District Commandant, Shri Ushakant Mankad, and Shri Pota to the hotel to see our facilities. They seemed quite bowled over by the facility offered and indicated that this was just what they desperately needed. Their own VHF was totally inadequate for the problems faced. Rajkot being the base station for the Home Guards for this rescue, a main station was immediately established in the office of the Commandant. A jeep was made available to us which soon was rigged up with HF mobile and 2-meter antennas. The team shifted to a hotel near the Home Guards office.

In Morvi, the Secretariat at Mani Mandir had been cleared of mud and activity was reviving. In the school compound nearby, a tent was provided for us where the equipment was installed, and contacts were made with Bombay, Ahmedabad, Baroda, and Rajkot, operating as VU2IJ. The aerial was a 20/40m dipole, while a twisted piece of wire round a bamboo pole provided for the 2m rig and did wonders.

The mobile jeep was out with the Home Guards during the day, in all the corners of Morvi, and conveyed information on 2m to the base at Morvi. This was relayed from the Morvi station to local persons and officials by messenger, or relayed to Ahmedabad, Baroda, and Bombay as required.

Most of the traffic concerned the Home Guards—deployment of personnel from the various districts, their transport and logistics, etc., as well as messages between the local officials and the District Commandant at Rajkot or the Commandant-General at Ahmedabad. Prior to our arrival at Morvi, a jeep had to make a trip of 70 km to Rajkot for the smallest item! Now a message could be conveyed at the press of a button! The frequencies used by us were 14150 kHz and 7050 kHz.

The equipment was jeeped back to Rajkot every night and taken to Morvi early every morning.

After a few days, Vasant VU2RX returned to Bombay and Jai VU2ED replaced him. Jayu VU2JAU was active in the Morvi/Rajkot operations and later at Ahmedabad.

No words can describe the dedication, hard work, acceptance of discomfort, and (initially) lack of food for many long hours with respect to the team operating in the Rajkot/Morvi area. The ingenuity shown in rigging up antennas (including mobile antennas on hand-held bamboo poles), and in making the equipment work under the most adverse conditions, deserves great praise. The average day was 14 hours; it sometimes was 24 hours. All operations in Morvi were on batteries, and these had to be carted to Rajkot for charging as there was absolutely no electricity in Morvi.

Equally deserving of praise were the hard-working teams in Ahmedabad, consisting of Pradeep VU2PCD (who was rushed off from Bombay at short notice) and Satish VU2CC, and the team of Jayant VU2JNT, Jayu VU2JAU, and Ramanbhai VU2MQ, who manned the club station, VU2GC, and relayed invaluable information to the government and Home Guards. Ahmedabad being the capital of Gujarat, communications with Rajkot/Morvi were vital.

Baroda was ably manned by Rayu VU2YY and Patil VU2XX. Rayu provided a rig at Ahmedabad and helped in many other ways. Arvind VU2XW also was operating.

At Bombay, prominent among those who monitored and relayed information were: Tipi VU2TP who was on the set almost 14 hours a day, Charlie VU2FP, Deryk VU2BEJ, Vasant VU2RX, Ishwer VU2AE, and myself. Jai VU2ED also was active until he went on to Rajkot.

The Atlas transceivers were a lifesaver. It is difficult to imagine how these operations would have succeeded but for this beautiful little piece, rugged, reliable, and easy to operate whether stationary or mobile. The 2-meter FM model IC-20 proved extremely useful and reliable and had a range of over 30 km, which was the maximum tried out.

This was invaluable when working parties went into mud-filled lanes and had to communicate with the base. The 2m SSB of Mizuho model SB2M is an equally reliable and useful piece of equipment, and with its shoulder strap and working on penlite cells, proved most useful in hand-held operations where even jeeps could not go.

The Chief Minister of Gujarat, Babubhai Patel, Home Minister Popatlal Vyas, and Commandant-General Udyan Chinubhai all visited the station and expressed deep appreciation of the facilities. Ushakant Mankad, District Commandant at Rajkot, who was directly in charge of the operations, was extremely appreciative of the work done.

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The facilities also were used by the Red Cross, Ramakrishna Ashram Camp, Sadvichar Pariwar, RSS, St. Xavier's College Team, Ahmedabad, Lions Club Relief Kitchen, Giants Club, and many other relief agencies.

Financial help in travel, lodging, etc., was provided through the efforts of VU2RX by the Lions Club of Juhu; Rayu VU2YY rendered invaluable help with equipment, finance, and in every other way. Large donations were collected by Vasant VU2RX.

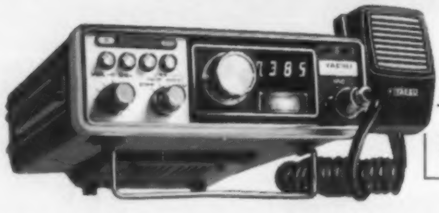
Hats off to the hams who put aside all work and for 18 days thought of nothing but providing emergency communications round the clock.

All praise to the manufacturers of the equipment which proved most reliable under adverse conditions.

Last, but not the least, all thanks to the Home Guards, who in spite of their preoccupations and round-the-clock work, looked after our lodging, food, transport, and every other requirement.

Gradually the position stabilized, and with the starting of telephones between Morvi and Rajkot, our usefulness diminished and operations were wound up on September 5th.

While we have the immense satisfaction of having done very useful work in an emergency and exposed amateur radio to hundreds of persons who had never heard of it, we also have realized how unprepared we were and how we lack suitable equipment and trained manpower. Hopefully, some urgent steps will be taken in this direction, and, hopefully, with some help from government and private agencies. ■



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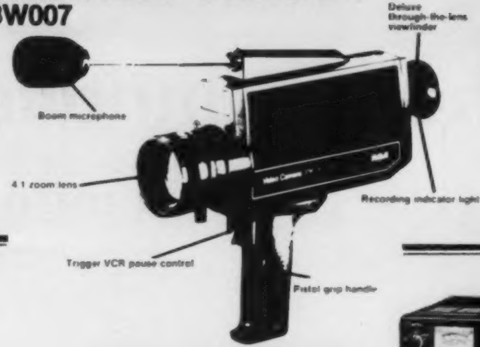
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Those Fabulous Fifties

—an era in retrospect

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Of course, you remember *your* old rigs, but what was everybody else using 25 years ago? I have two different "dream" stations from 25 years ago. One was pictured on the cover of the 25¢ ARRL pamphlet, "How to Become a Radio Amateur." It showed a youth sitting in a room that was plastered with QSL cards. Apparently everything the kid needed in order to get those QSL cards was on the desk in front of him: A little home-built two-tube receiver and a one-tube home-built transmitter constructed on a wood chassis with an 80-meter coil wound of red and white bell wire. *That* was my dream station back in 1952. I stared at this cover photo for hours while I was studying the code and the questions for the Novice test.

I never saw a picture of my *other* dream station. I first heard of it in 1953, just after I got my General ticket. This hot-stuff dream rig was supposedly owned by a farmer someplace west of me in the state of Kansas. I never knew who this guy was, nor did I learn his name or call. (Today, I'm not sure he ever existed.) He had a *complete* Collins station: 75A-3 receiver, 32V-3 exciter, and KW-1 final. Remember, this equipment went for over $5000 in 1953. To top it all off, so the story went, the guy had a forest of telephone poles, with rhombics going off in eight directions.

As I recalled these thoughts recently, I figured that it would be interesting to find out what the average ham really used 25 years ago. So I dug out a bundle of QSL cards from 1953-55, my first three years on the air as a Novice and as a General class license holder. Some of you may be a little surprised, as was I, to discover which rigs were the most popular in 1953.

It was an interesting time for amateur radio. World War II was recent enough so that there was still lots of surplus gear around. The Novice class license was a new option and the market for ham gear was opening up, yet you could still go into radio outlets like Burstein-Applebee in Kansas City or Walter Ashe in St. Louis and buy single resistors and other small component parts. At Fort Orange Radio in Albany NY, they even sold rf cigars! At least their ads always showed "Uncle Dave" W2APF in his shack calling

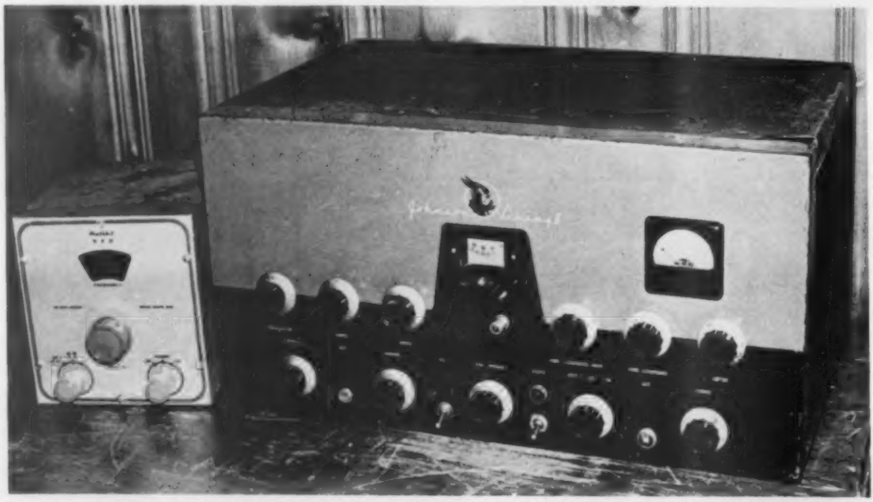

Fig. 1. Viking II transmitter with Heathkit VF-1 vfo. Photo courtesy of W1FYM.

CQ with rf coming out of his stogie.

My first rig was a National SW-54 allband receiver and a home-brew single 807 transmitter using an end-fed Zepp antenna on 80 meters. It seems that I was not at all unusual in starting with a home-made transmitter and a commercially-built receiver. I entered ham radio long after the time when hams made their own condensers out of mason jars and foil, but home-built and surplus conversion rigs were very common.

I dug out a bundle of seventy cards, sent by hams from Maine to California to me in Grandview MO. I went through these and made a list of the rigs, antennas, and bands used by each. Let's look at the transmitters first. Eleven cards described home-built transmitters of less than 100 Watts input and another eleven home-brew jobs ranged from 100 Watts to a kW. Four more rigs were BC and ARC Command series war surplus conversions, and forty-four rigs were built from kits or were purchased ready-made.

Far and away the most popular transmitter I worked during the mid-1950s was the Johnson *Viking* series. Seventeen of the seventy rigs listed in my bundle of cards were Vikings, many of which were home-built. The Viking II had just come out; its predecessor, Viking I, was very popular and the improved model seemed to be everywhere. It was available in kit form only in 1953 and went for $279.50, with a pair of 6146 finals modulated by a pair of 807s. There are still a lot of Viking rigs in use today, many of which are operating on the 27-MHz Citizens Band. The E. F. Johnson company, like Hammarlund, James Millen, and many other radio companies, advertised its component parts at great length in the radio magazines, but Johnson really came into its own with the Viking series. Soon they added the Viking Ranger, along with regular and mobile vfo kits. Eventually, by the late 1950s, they had a whole line of transmitters, from the Adventurer (a small CW rig) to their kilowatt final console, which was built into a desk. The Johnson stuff was good gear. When I was at Stanford University, the EE department took a great many Viking kilowatt finals and converted them to 2-kW pulse amplifiers which were used all over the world during the IGY for HF radar backscatter experiments on 14, 21, and 28 MHz.

After the Viking I and II transmitters, the next most frequent model mentioned in my bundle of QSL cards was the Cadillac of ham gear, the Collins 32V series, of which I worked five examples. The 32V-3 cost $775, with its 4D32 tetrode final modulated by a pair of 807s. Seven of the seventy rigs were put out ready-made or in kit form by Leo Meyerson's World Radio Labs in Council Bluffs IA. Four of the seven were his big 400-Watt Globe King models, rigs designed to utilize a pair of wartime-produced final tubes, two V-70-Ds which were like 812s except they had 7.5-volt filaments. Leo also put out Globe Trotters, Scouts, Chiefs, and Champs, advertising "More workable Watts per dollar." The Globe King was a real boat anchor—the first several models were coil-changing types and one was in a Bud Company cabinet three racks tall.

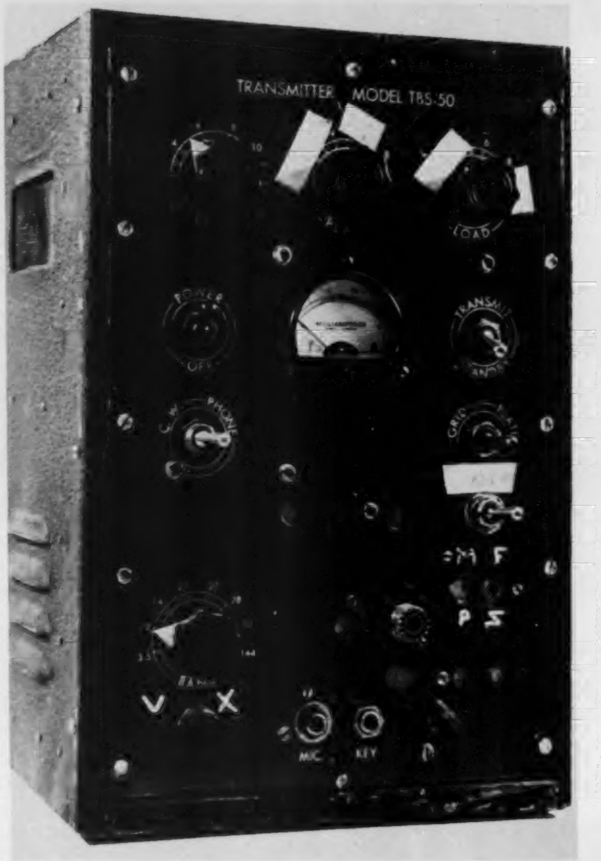

Fig. 2. *Harvey-Wells Bandmaster transmitter. This example has been much modified over the years.*

Most popular among the little commercial rigs was the Harvey-Wells Bandmaster series (TBS-50 to 50D). Four of the seventy cards were from guys using Bandmasters. This little 807 rig was described optimistically as working from 80 meters clear down to 2 meters, with top band operation possible if you built up the capacitance and inductance in the 80-meter tank circuit. Now, the 807 tetrode was only designed to go up through 6 meters at full ratings, and the Bandmaster plate-current meter was useless at 2 meters, so you had to tune it using a flashlight bulb! Pretty primitive—but it didn't matter much, since the other guy on 2 was probably using a Gonset Communicator. Depending on whether you wanted the stripped down "Junior" or one of the more fancy models, the Bandmaster went for about $160 in kit form, including power supply. Included among the other rigs I worked were Heath (they came out with the AT-1 peanut whistle about 1954, then the DX-100), Meissner, Elmac, Tenar, and Sonar Engineering.

The home-brew rigs I worked went all the way from a 6AG7 oscillator/6L6 final running 12 Watts up to one guy using a pair of 250s at a full gallon. Overall, the home-builder seemed to choose a 6L6 final for low-power rigs and a single 807 or pair of 807s (or its 12-volt version 1625) for medium-power rigs. The bigger boys ran tubes like the 812, 813, or 250. As I remember, at least half the hams were rockbound. Vfos were outboard accessories for most rigs. All sorts of little outfits

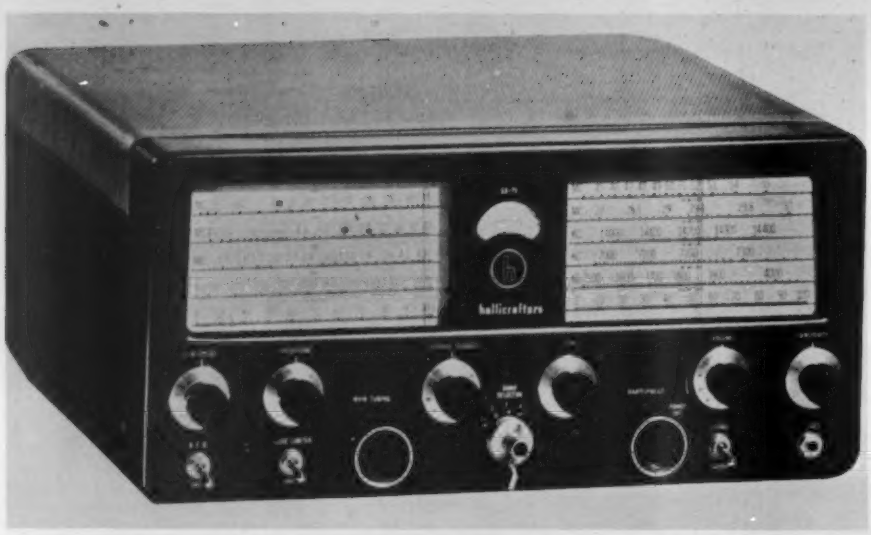

Fig. 3. Hallicrafters SX-71 receiver, introduced in 1950.

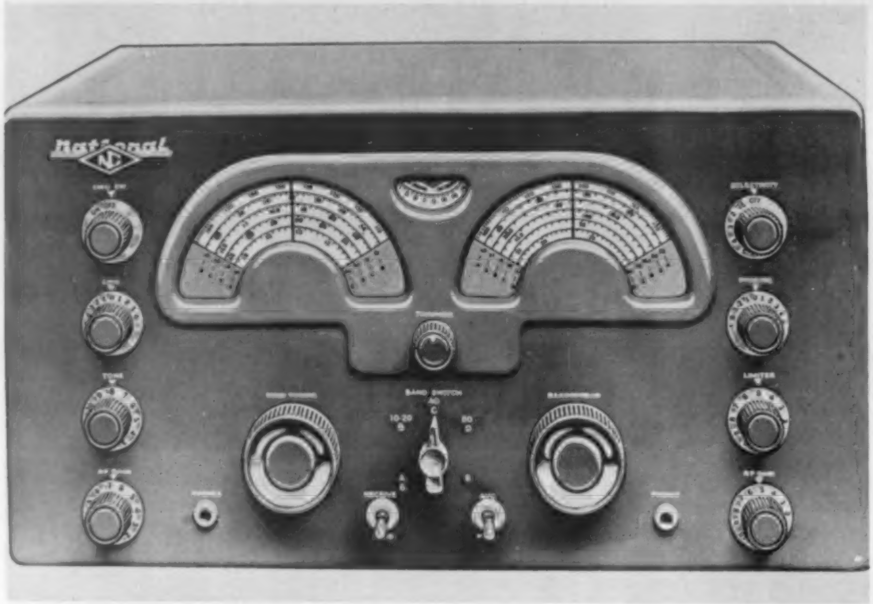

Fig. 4. National NC-183D receiver. This model was new in 1953, based on the NC-183, introduced in 1948. Photo courtesy of National Radio Company.

(between the Ozarks and Chicago) were sources of cheap crystals in FT-243 holders. We could adjust some of these by grinding them with toothpaste or grinding compound. The crystals cost less than $1.00 apiece, and if you ground one too unevenly, causing it to quit oscillating, it was no great hardship to throw it away.

Going back over those seventy QSL cards, I was surprised to find Hallicrafters so dominant among receivers. Almost half (thirty-four) of the receivers were Hallicrafters, including ten of the model SX-71s. The SX-71, at $225, was the cream of the "medium price class," as the Hallicrafters ads used to say. It was a double-conversion superhet with eleven tubes and a rectifier, covering the broadcast band up through 6 meters. Among the other Hallicrafters receivers worked were SX-99s, S-76s, S-43s, S-42s, quite a few S-40s, an S-28, S-24, S-20, S-17, and a couple of S-38s. I remember the S-38s well because I had their rival—National's SW-54. Each of these little table radios sold for a few cents under $50. National produced seventeen of the other receivers listed: the NC-183, -173, -125, -98, -88, -46, and the famous HRO series. The third most popular receiver manufacturer was Hammarlund, with nine examples including the HQ-129, the HQ-140, and the celebrated "Super Pro." I worked only a couple of guys with Collins 75A-series receivers. It was beautiful gear, but too expensive for most of us. In 1953, the 75A-3 cost about $670 with all accessories.

Of course, for commercial and military use, Hammarlund made the SP-600, Collins the 51J series, and Hallicrafters the SX-73. We only heard of these at military base ham and MARS stations because they ran all the way up to $1000 per receiver. Quite a few fellows used the surplus World War II receivers on 80 and 40 meters, or with converters for the higher frequencies.

Looking over the old cards for their choice of antennas, I divided the cards into low bands (80 and 40 meters) and high bands (20 through 10 meters). On the higher bands, everybody seemed either to have a beam or else merely a dipole. Some beams were all-grounded "plumber's delights." Telrex was *the* beam to own, although I often worked Mosley, Hy-Gain, and other beams. I don't remember working anybody who had anything other than a 2- or 3-element beam, although some of these were "mini-beams" and "tri-beams." Quads were not heard of (at least not around my area) in those days. Eventually I got 3 elements on 20 meters and 3 elements on 10 meters, and I turned them with a chain-driven, prop-pitch motor or with a pipe wrench (most of the time). Lots of guys used prop-pitch motors for bigger arrays and selsyn motors for smaller antennas. The selsyns wouldn't always turn

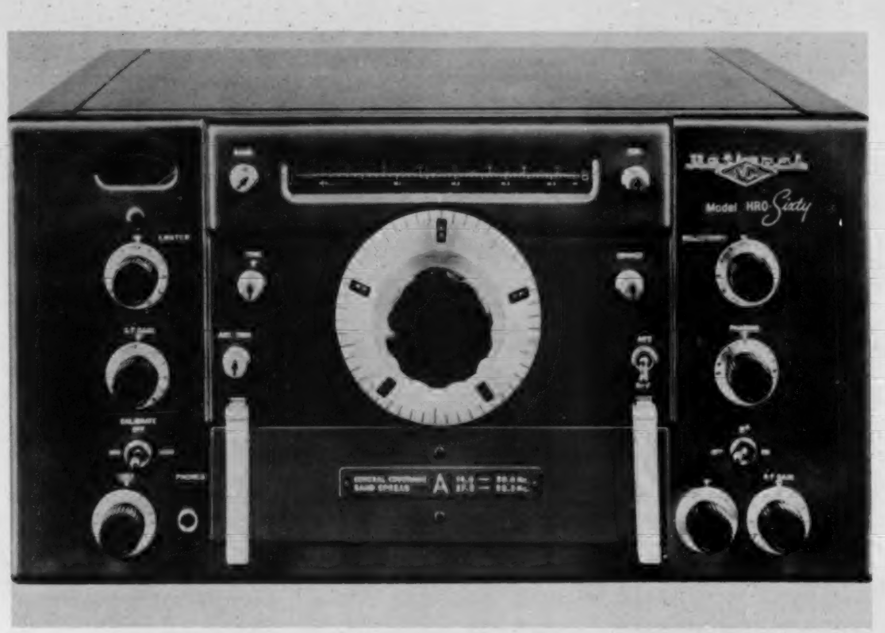

Fig. 5. The National HRO receiver. The first HRO, a 9-tube superhet, was introduced in 1934. All featured the famous "PW" HRO precision-ganged tuning condenser. The HRO-Sixty, shown here, came out in 1953. Photo courtesy of National Radio Company.

since they had limited torque and they sometimes "hunted" for each other. That is, the selsyn in the shack and the selsyn on the tower would end up pointing in some mutually satisfactory direction unknown to the chief op.

As you might expect, the low bands turned up a larger list of antenna types, though most were wire antennas. Half of all antennas worked were dipoles, with the plain dipole or "doublet" in use more often than the popular folded dipole. This latter came into use after World War II when plastic-covered 300-Ohm line became readily available at TV stores. Only a few hams among those in my bundle of seventy QSL cards used verticals. It was still some time before the trap vertical was used as a popular antenna. Finally, there were a few off-center-fed wires which the operators usually called "Windom" antennas. Others used end-fed wires including a half-wave wire end-fed with ½- or ¼-wave 600-Ohm open-line feeders. This "Zepp"-type antenna had been developed for use on the German Zeppelin airships. In the mid-50s, 600-Ohm open-spaced line and 75-Ohm twisted-pair wire were still often used.

I have reported only on CW and AM contacts in my bundle of QSLs from 1953-1955. I did not get a chance to operate SSB until 1958, but one heard the "Sidewinders" or "Donald Ducks" on the phone bands 25 years ago. *The ARRL Handbook* introduced a chapter on SSB and also on DSB (double sideband) techniques. Everybody was learning how to tune in the stuff (rf gain down, af gain up, fiddle with the bfo . . .). Central Electronics of Chicago was selling SSB exciters and other companies quickly got on the bandwagon. As for AM rigs, most guys I talked with had high-level plate-modulated transmitters, although quite a few used the cheaper cathode- or grid-modulated approaches. I remember a radio handbook photo of a one-tube cathode modulator which plugged in the CW key jack.

Among these seventy QSLs from 25 years ago are four from YL operators. My mother thought I was driving the house crazy talking about ham radio, so, unknown to me, she went down and took her Novice test and passed. She drove up one spring day to where our high school track team was practicing and just showed me her Novice ticket. She later passed her Technician ticket and became W0TRC.

The Heath Company was beginning to expand their line of instrument kits, but most hams I knew didn't have much test equipment back in 1953. WWII surplus instruments usually amounted to signal generators and voltmeters. I knew one guy who had a Dumont three-inch scope and one other fellow who owned a

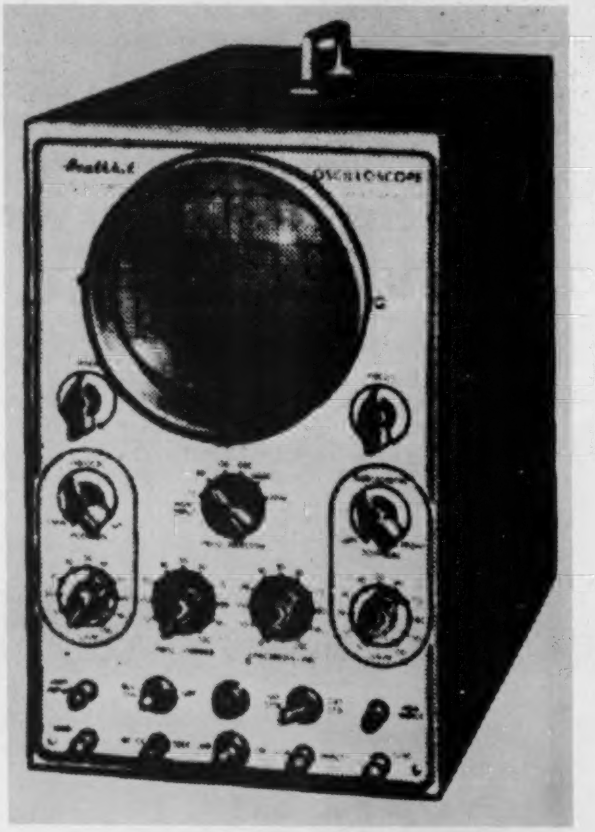

Fig. 6. Heathkit model "0-8" 5-inch oscilloscope, dc to 1 MHz, $43.50 in kit form in 1953. Drawing courtesy of Heath Company.

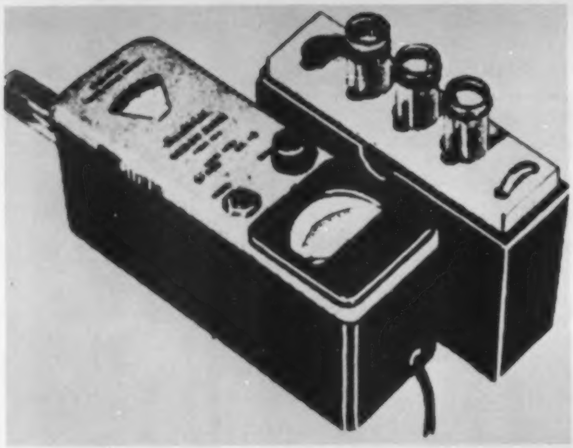

Fig. 7. Heathkit model "GD-1" grid-dip oscillator, 2 to 250 MHz, $19.50 in kit form. Drawing courtesy of Heath Company.

grid-dipper. Several hams that I knew owned VTVMs, but the vswr meter was rather rare around my neighborhood. The extent of my own test gear in the 1950s was an Eico multimeter kit which I built for $12.90. I also had a neon bulb for an rf indicator. At this time I was only a high-school kid and therefore not expected to own much test gear. But I really don't remember my older ham friends owning much test gear, either. What I *did* seem to covet were Greenlee metal chassis punches. They weren't cheap, but I managed to collect four or five, for octal sockets, miniature sockets, etc. Somehow, I always seemed to mangle the minibox I was working on, even when I was using a chassis punch.

My brief survey of some hams I worked 25 years ago doesn't pretend to be the last word in statistical sampling. If you chose to go back 30 years, you would not find many hams with commercial kit transmitters. If you go back only 20 years, you would find that SSB was really getting a major part of the market. For example, E. F. Johnson had several SSB exciters to go with their "Viking Kilowatt," Hallicrafters had the HT-32 SSB exciter and HT-33 kW amplifier, and Collins had their "S" line. Perhaps, if you had lived in a different region than me, your sample of cards would include hams who used Eldico, Gonset, Eico, B & W, RME, Tecraft, Central Electronics, or other gear.

All in all, most hams 25 years ago weren't appliance operators. Nearly everyone had a commercial receiver, but about ⅓ used home-brew transmitters with another ⅓ using commercial designs built from kits. If you worked one of my "average" hams in 1953, he probably used a dipole on the lower HF bands and a dipole or beam on 14 MHz and above. Most likely he was running an 807, a pair of 1625s home-brew, or a kit-built Viking II, and he was receiving you on an SX-71. Chances are one of you had a vfo and the other was rockbound.

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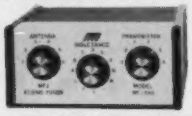

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Trash All Your Worries

—Baron Von Rhonstead and the RFI caper

The big German Shepherd had five half-Doberman pups. Some 18-wheeler zooming by my wife's new car at 80 mph shattered a window. The water softener quit, belching salt water all over the place. The 100-pound Doberman, the Baron Von Rhonstead, ate all the patio plants. The ice-maker leaked water which froze in great globs all over the freezer compartment and I never even noticed.

When that UPS delivery van arrived a few weeks ago, I felt like a Third Avenue barfly on his first day as a paid whiskey tester.

I don't know how my wife Malinda WD5JZS ("Joe's Zany Sidekick") felt about that new TRS-80 because I didn't communicate with her for three weeks after it arrived, except when food was passed under the shack door. She said I grunted an occasional string of unintelligible noises familiar to Marines, bos'ns, and other denizens of the deep, but I don't recall.

For years, this guy Wayne Green has been yap, yap, yapping about computers and how any self-respecting ham had better get off his ROM and CLOAD the program.

But, you see, I was at a disadvantage. I was not an engineer. I knew only slightly more about electronics than did Attila the Hun and my experience with computer language was limited to that on Visa and Master Charge bills which elicited cries from Malinda each month: "What is Macrotronics?" or, "What does Long's sell?" or, "What do you make with Icoms?"

I knew even less about computers than I did about RTTY, but I couldn't wait to tear into that carton and stick wires on the Macrotronics M80 board and on the Flesher TU-170 which arrived at about the same time.

Since I had just mailed my log to the World Ecumenical Council for the WAC Award (you know the one—Worked All Churches) and because I was appealing to the ARRL for their coveted WAEB Certificate (Worked All Electric Blankets), I had briefly considered what might happen to the plastic-housed video monitor image with rf around. What I had not yet pondered, though, was how to explain to ol' WD5JZS about the RTTY "bug," late "nightitis," and frantic rushes home at noon to solder a connection or two.

Photo A. Unsuccessfully sniffing the shack of WA5TUM and WD5JZS for RFI are the "Royal Noses," quintuplet offspring of the Baron and Baroness Von Rhonstead. A ham can operate the TRS-80 microcomputer on RTTY within inches of equipment radiating the legal limit. The unique rf detectors, combining in a 50-50 mixture the intelligence of the German Shepherd and the tenacity of the Doberman Pinscher, were unable to catch even one wild electron.

WD5JZS thinks that RTTYers sleep in old hollow logs, have a shell on 'em kinda like an armadillo, and bay at the moon. What she didn't know was that RTTYers don't sleep at all and that the immediate problem seen through my bloodshot eyes was the beautiful effect of Dentron MLA-2500 a la TRS-80. The CRT made fascinating patterns right after the program crashed, and I now wish that some of them had been "CSAVEd" for the RTTY pix freaks.

Even with limited knowledge of the esoterics of electromagnetic theory, it didn't take Tesla to tell me that "When everything is grounded and you still have a problem, then everything is not grounded," or at least the point that an electrical ground "ain't necessarily an rf ground."

I had, I thought, one of the better grounds around: some 150 feet of buried half-inch copper pipe running in two different directions, the tower base sticking below eight feet of concrete into three feet of deep earth, and all equipment tied within six feet of the buried pipe. It wasn't perfect, but this wasn't designed to be the 50,000-Watt "Voice of South Texas."

After grounding was checked, I bought an aluminum chassis box from the "doughnut shop" in Corpus Christi. That's the nearest ham store, Douglas Electronics, which specializes in top-name goodies, friendly service, coffee, doughnuts, and an outstanding reputation for keeping charge accounts stamped, "Top Secret." Wives see only select bills, and Bob Douglas W5GEL and crew keep an assortment of old oil-can cartons around, so the shiny new Icom or Kenwood goes home so covertly that the best KGB agent would never suspect.

The chassis box, about six inches by four by four, was ideal because with the M80 board inside and rubber feet on the bottom for height, the TRS-80 bus could be run through a slit, level with the CPU connector, leaving almost none of the wire exposed to nasty RFI.

Photo B. Wearily watching sunrise after chasing loose electrons all night, WA5TUM finally found keys to success in rounding up RFI for full power RTTY operation with the Radio Shack TRS-80 microcomputer system.

What a difference that grounded box made! It was particularly neat with RCA phono tip connectors mounted for hookup convenience, an off-on switch, and the two LEDs peeking through grommets for easy monitoring. I could then transmit up to 600 Watts on 20 meters without too much RFI, which was plenty of muscle for me.

I reached down, punched in the RM-2 microprocessor to call up 40 meters on the Icom-701, and Zaaaapp!!!

At anything more than 75 Watts, the video monitor information danced all over the screen, rolled, did back flips; it turned a muddy black at 200 Watts. RAM wasn't disturbed, though, so progress had been made.

Into the dry Drake dummy load, actually touching the video monitor and the TRS-80 terminal, the MLA-2500 kicked out enough stomp to peg the needle at 2,000 Watts, leaving image and program steadier than John Wayne's aim in *True Grit*.

That, at least, indicated a "clean" shack.

My friend, Guy Ford at the doughnut shop, again came through and sent a sack of ceramic disc capacitors—20 or so—and I attached them to everything. For security, I even carried a few around in my pockets. All eight wires of the CDE T2X "Tailtwister" through the caps found a trail to ground and so did all Flesher TU-170 connections. A couple of surplus military grade .001-uF 1,000-volt mica caps were placed on ac mains to ground at the primary circuit box, and even individual branches to the shack were similarly grounded.

Again, Zaaaapp!!! Everything was fine at 600 Watts or less on 10, 15, 20, and 75 meters, but on 40 it was only a hair better, with the video screen at more than 250 Watts looking like Wiley E. Coyote after a run-in with the Roadrunner.

I broke out the tape measure, ordered a winch truck to lower the 5,000-pound home-brew tower (constructed from 3" o.d. steel oil well drilling offset tubing, welded every four feet with massive 1/4" steel plates between tower legs), and measured the thing from base to beam.

I could have climbed the tower, but I wanted to make sure that the tower was as long as it was tall. You see, an engineer friend of mine, Joe Bethancourt, ex-WA7TUM and now WD5FYR, who graduated from Texas A&M University, told me there might be differences in height and length. Not being an Aggie or an engineer, and trusting a fellow TUM, I wanted to be sure, so I measured it standing and lying down. Both ways, it came to 66 feet, although when lying down I really had to stretch to read the tape.

A handbook printed by a well-known Eastern Establishment ham organization had a formula for wavelength, and when I divided their 468 by anything between 7.070 and 7.090 MHz, I came up with about 66 feet, or a shade more, depending on which pencil I used.

Aha! The shack, one-half wavelength on 40 meters directly below that beam, put the TRS-80 video monitor right in the core of the ground field of the antenna. Long may my retinas live, Ralph Nader.

What next? Well, I crawled up in the attic, where in South Texas that space hovers at 180 degrees, rubbed in some fiberglass so the XYL would feel sorry for me, and dreamed of an air-conditioned Faraday shield up there. I thought I could perhaps build the shield in the garage and then carefully move it up to the attic and spread it out.

No, I thought, too much work and too uncomfortable. And one thing I had not yet done was to filter the ac line with rf chokes.

In a junk box, I found a couple of surplus chokes of no-telling-what value and built the thing into a small chassis box using appropriate ceramic caps. Since the shack and the 40-circuit breaker box for the house are adjacent, separated only by studs, insulation, and paneling, and because both were directly below the beam at 66 feet, I prayed that filtration would help.

And, it did! The rig could then transmit about 300 Watts on 40 meters before the image went into the "Twilight Zone."

The doughnut shop again tossed a lifeline. I decided that if my crude home-brew filter helped, then a custom-made-for-computer filter would work even better.

My bill at the doughnut shop is always competing for top spot with gasoline charges, and, "What the heck?" I thought, "Buy three of these little jewels—they're only $9.75 each." (With my soldering ability, I always get two spares.) I stuck one of these in with the home-brew filter and soldered them together. You know the reason: "If one works well, two will work better." I apply that same philosophy to medicine—especially hot toddies.

Two didn't work much better, even if one prescription did come from the experts who really know how to build filters.

Returning to the old law, "If you still have a problem, check the grounds," I drove in two new ground rods and bonded 'em to the tower and, just in case the electricians hadn't done their jobs, to the house circuit breakers.

That didn't help, except for peace of mind.

What should have been my first step turned out to be the last, but earlier I did not want to break seal on the video monitor while the thing was under warranty. By this point, however, warranty be damned! I got aluminum screen wire off a neighbor's window, about two feet by two, removed the back of the TRS-80 video monitor, and made a shield below, above, and all around the entire guts of the thing. (The neighbor donated the screen that the Baron tore, but that's another story.)

TRS-80 owners will notice that the slide-out video monitor chassis is attached by a ground wire on the left side. When the ground wire is removed, this allows the chassis to slip out.

I cut a piece of stiff poster paper to fit the bottom of the printed circuit board, which is mounted on an aluminum frame, and slipped it in for insulation in case the screen were ever to touch the PC board. A piece of screen was cut to that same size and used for shielding the chassis bottom.

The remaining screening was trimmed to size and placed on all sides of the chassis, extending up and around the CRT. It was fastened in place by sheet metal screws in holes conveniently provided on the flimsy aluminum frame holding the printed circuit board.

I was careful first to tape all bare connections around the CRT, its neck, and high voltage sections before stuffing the thing back in its case, with a capacitor running to external ground.

That completed the job. One thousand Watts to the antenna doesn't even wiggle the image on any band!

Whether this will heal everyone's TRS-80 RFI headaches, I don't know. I do print, though, a number of RTTYers complaining of TRS-80 RFI either from their transmitters or from the CPUs into their receivers.

Even though it was never a significant problem with the Icom-701 receiver, the slight bit of CPU-generated RFI seemed to vanish when the M80 and bus were shielded.

I finally realized that chasing capacitors, rf chokes, and grounding logbooks to beer cans, coupled with time spent learning something about Level II BASIC and RTTY, had all but totally curtailed communication with the most important ham in town, WD5JZS.

But, I also neutralized harmonic interference from the kitchen. A nice floral arrangement, delivered to her desk during the third week with a note expressing my appreciation for her understanding, prompted Malinda to CSAVE me, the shack, and the TRS-80.

It's like soldering capacitors to everything. Each step helps, but no effort by itself completes the job. Tonight I cooked dinner, and tomorrow I'll order the M800 stuff right after I do the laundry. ■

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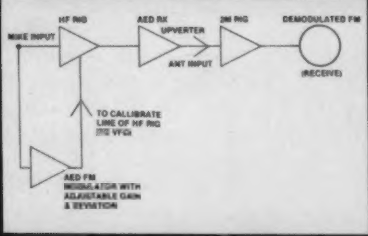
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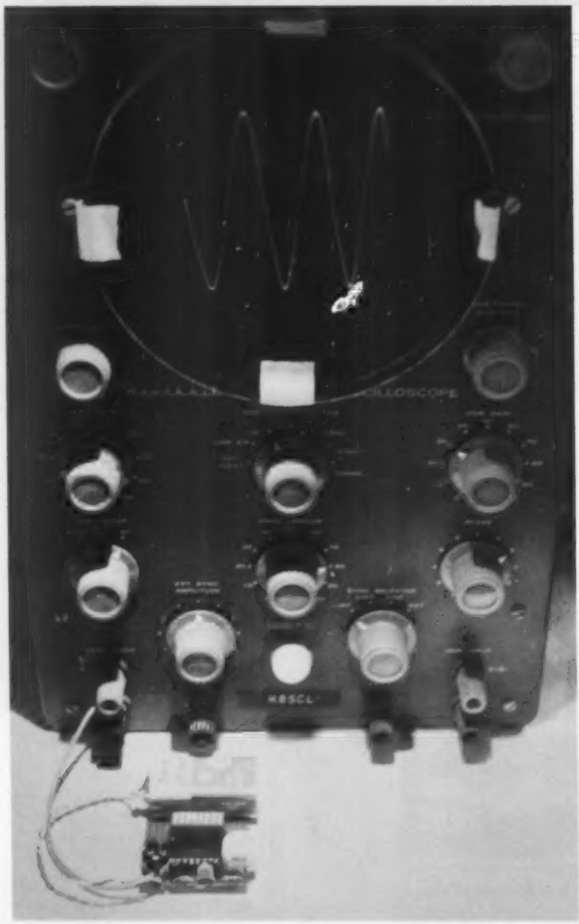

The finished unit showing filtered output and its relative size compared to a 9-volt battery.

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Do you say you always wanted a Private Line—and more than one or two? (PL is a registered trade name of Motorola.) Then this circuit is just for you.

Being a traveling man, I have been looking for a circuit that would generate the PLs required in the areas I frequent.

Ohio and Michigan have used continuous tone-coded squelch systems (CTCSS) for a number of years. The CTCSS was designed for commercial two-way radio systems to allow many users on the same repeater or to allow adjacent repeaters to use the same frequency. Skip and other less mentionable things have made it advantageous to have this ability on an amateur radio repeater. Most of the time a PL is not required. It is only in the rare instances when problems exist that it is implemented.

It is at these times that I find myself needing the PL frequencies of 71.9 Hz for central Ohio, 100.0 Hz for Detroit and Toledo, and 110.9 for northeastern Ohio. They are not a bargain, for sure, at the price of commercial units. Then—Eureka!—the LSI (large-scale integration) boys did it again: a digital tone-generator chip with a price of under $5 each.

Design Objectives

The specifications that are important to the design of a CTCSS digital tone generator are: sine-wave output, stability (frequency, temperature, and level), and wide operating supply voltage. The sine-wave output with low distortion is to prevent harmonics from entering the 300-Hz to 3400-Hz receiver audio band and to have it stay subaudible as it should. Frequency stability and ac-

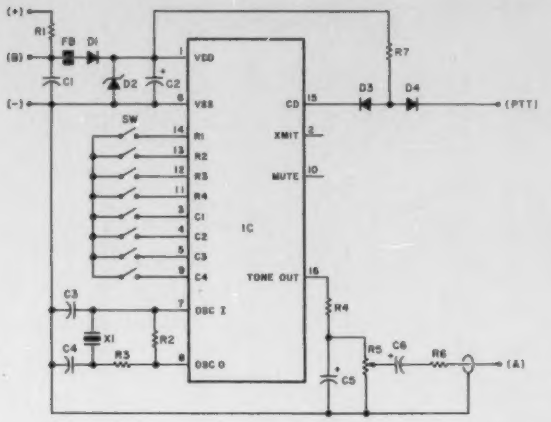


Fig. 1. Schematic diagram.

curacy must be ±2 Hz from center frequency to activate most decoders.

General Description

The American Microsystems S2559B/D digital tone generator was specifically designed to implement a dual-tone telephone dialing system. The device can interface directly with SPST switches. All necessary frequencies are derived from a crystal standard providing very high accuracy and stability. The required sinusoidal waveform for the individual tones is digitally synthesized on the chip. The waveform so generated has very low total harmonic distortion.

A voltage reference is generated on the chip which is stable over the operating voltage and temperature range and regulates the signal levels of the tones. The switches are arranged in a row/column format (4 rows x 4 columns). The active row input selects one of the four row frequencies, and the active column input selects one of the four column frequencies.

In standard dual-tone telephone systems, both tones are used. The frequency tolerance must be ±1.0%. However, the S2559 provides a better than 0.75% accuracy. The total harmonic distortion of the tone must be less than 10%. (The output filter provided by R4 and C5 improves this to about 2%.) The absolute amplitude of the tones must be within a controlled range. These requirements apply over the operating temperature range.

Features of the S2559:

- Wide operating supply voltage range: 3.5 to 13 volts (B), 2.75 to 10 volts (D), with outboard regulator, 3.5 to 18 volts. (See schematic.)
- Low power CMOS circuitry allows device power to be from small batteries, e.g., 9 V.
- Uses crystal standard to derive all frequencies, thus providing very high accuracy and stability.
- MUTE and transmitter drivers on-chip.
- Interfaces directly with switches.
- The total harmonic distortion is low.
- On-chip generation of a reference voltage to ensure amplitude stability of the tones over the operating voltage and temperature range.
- Dual-tone as well as single-tone capability.

Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	52.6
R2 C1,2	—	57.6
R3 C1,2	—	63.7
R4 C1,2	71.9	71.3
C1 R1,2	91.5	91.4
C2 R1,2	100.0	100.1
C3 R1,2	110.9	110.7
C4 R1,2	123.0	123.7

X1 – fa = 269.14 kHz

Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	54.2
R2 C1,2	—	59.5
R3 C1,2	67.0	65.8
R4 C1,2	74.4	73.6
C1 R1,2	94.8	94.4
C2 R1,2	103.5	103.4
C3 R1,2	114.8	114.3
C4 R1,2	127.3	127.7

X1 – fa = 277.98 kHz

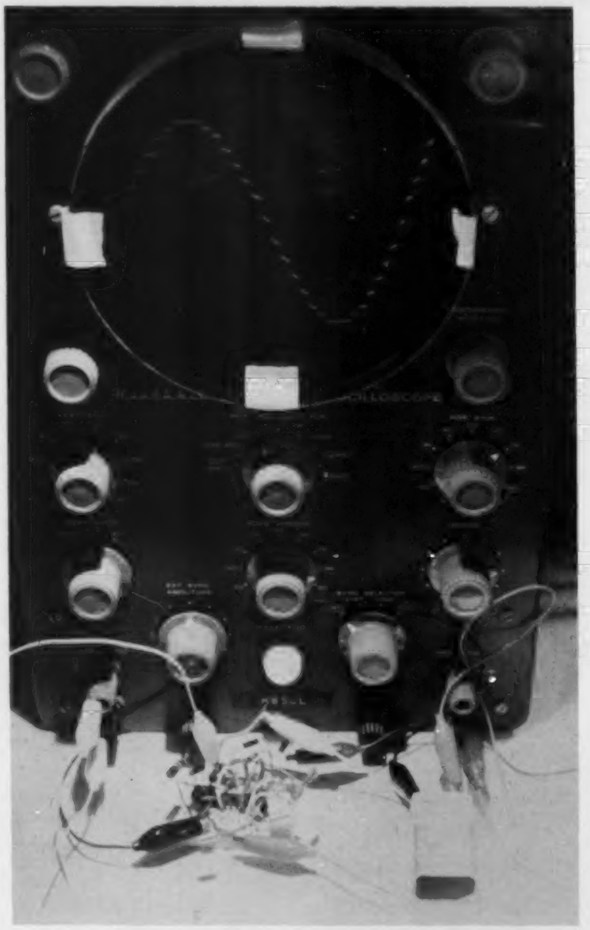
Switch Position	EIA Tone	Actual Tone
R1 C1,2	—	56.2
R2 C1,2	—	61.6
R3 C1,2	67.0	68.2
R4 C1,2	77.0	76.2
C1 R1,2	97.4	97.8
C2 R1,2	107.2	107.1
C3 R1,2	118.8	118.4
C4 R1,2	131.8	132.3

X1 – fa = 287.89 kHz

Switch Position	EIA Tone	Actual Tone
R1 C1,2	–	64.6
R2 C1,2	–	70.9
R3 C1,2	–	78.4
R4 C1,2	88.5	87.7
C1 R1,2	*	112.5
C2 R1,2	123.0	123.2
C3 R1,2	136.5	136.2
C4 R1,2	151.4	152.2

X1 – fa = 331.19 kHz

*Fig. 2. Frequency chart. fa = frequency anti-resonant; * = not EIA tone, but WR7ANP, Tucson, is listed using 112.7.*



The breadboard circuit showing the stairstep waveform.

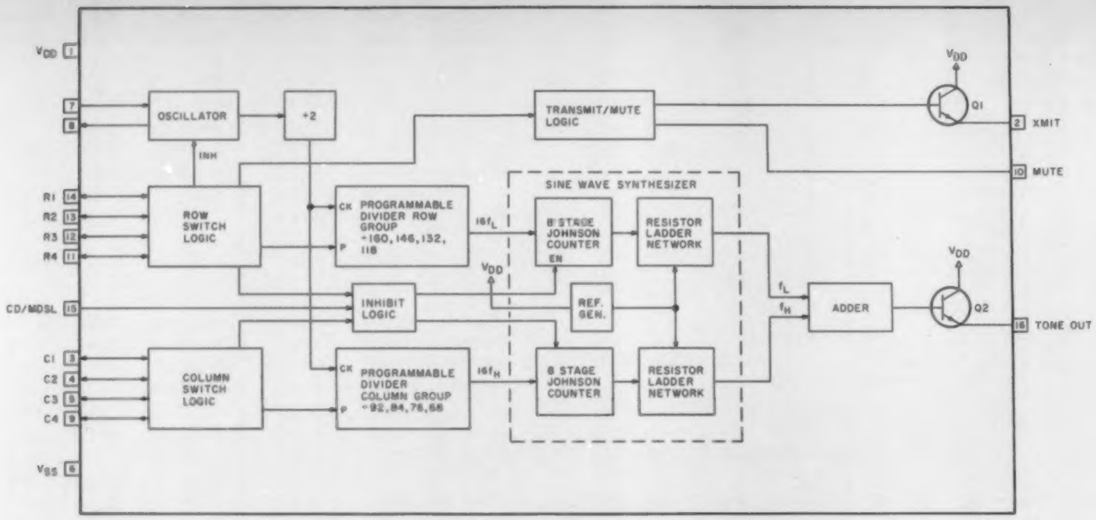
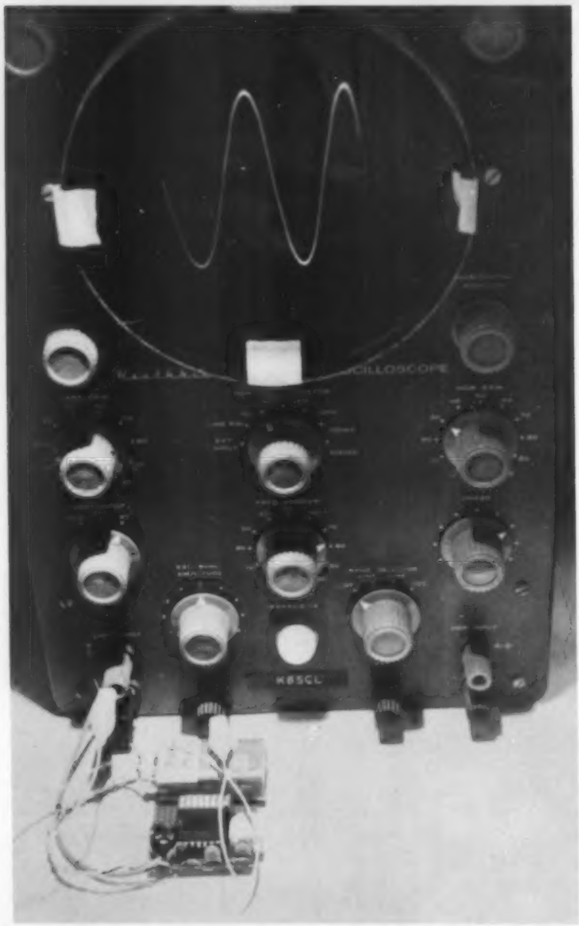

VDD 1
7
8
OSCILLATOR
INH
÷2
TRANSMIT/MUTE LOGIC
VDD
Q1
2 XMIT
10 MUTE
SINE WAVE SYNTHESIZER
R1 14
R2 13
R3 12
R4 11
ROW SWITCH LOGIC
CK
P
PROGRAMMABLE DIVIDER ROW GROUP ÷160, 146, 132, 118
16fL
8 STAGE JOHNSON COUNTER
EN
RESISTOR LADDER NETWORK
VDD
CD/MDSL 15
INHIBIT LOGIC
REF. GEN.
fL
fH
ADDER
VDD
Q2
16 TONE OUT
C1 3
C2 4
C3 5
C4 9
COLUMN SWITCH LOGIC
CK
P
PROGRAMMABLE DIVIDER COLUMN GROUP ÷92, 84, 76, 68
16fH
8 STAGE JOHNSON COUNTER
RESISTOR LADDER NETWORK
VSS 6

Fig. 3. Block diagram.

Oscillator

The device contains an oscillator circuit on-chip so that it is necessary only to connect a 10-megohm feedback resistor, the necessary capacitances, and a standard crystal across the OSCI and OSCO terminals to implement the oscillator function. (A ceramic resonator was used in place of the crystal to lower cost.) The oscillator operates whenever a row input is activated. The oscillator frequency is divided by 2 and then drives two sets of programmable dividers, the row group and the column group.



One-volt calibration level.

Switch Operation

The S2559 employs a calculator-type scanning circuitry to determine switch closures. When no switch is selected, active pulldown resistors are ON on the row inputs and active pullup resistors are ON on the column inputs. When a row switch is selected, a high level is seen on one of the row inputs, the oscillator starts, and the scan logic turns on. The active pullup or pulldown resistors are selectively switched on and off as the scan logic determines the row and the column inputs that are selected. The advantage is that an arrangement of SPST switches can be used, without the need for a common line.

Logic Interface

The S2559 can interface with CMOS logic outputs directly. Active high logic levels are required. Since the active pullup resistors present are 500-Ohm typical, diodes can be used to eliminate excessive sink current flowing into the logic outputs in their low state.

Tone Generation

When a valid switch closure is sensed, the row- and column-switch logic programs the row and group dividers with appropriate divider ratios so that the outputs of these dividers cycle at 16 times the desired frequencies. The outputs of the dividers drive two 8-stage Johnson counters. The symmetry of the clock input to the two divide-by-16 Johnson counters allows 32 equal time segments to be generated within each output cycle.

The 32 segments are used to digitally synthesize a stairstep waveform to approximate the sine-wave function (see Fig. 4). This is done by connecting a weighted resistor ladder

Parts List

	Radio Shack Parts No.		
Capacitors			
C1 – 0.01-uF, 50 WV dc disc ceramic	272-131	2/.29	.15
C2 – 10-uF, 16 WV dc tantalum	272-1411		.49
C3 – 120-pF, 1000 WV dc disc ceramic, temperature-stable			.15
C4 – 330-pF, 1000 WV dc disc ceramic, temperature-stable			.15
C5 – 1-uF, 35 WV dc tantalum	272-1406		.39
C6 – 4.7-uF, 16 WV dc tantalum	272-1409		.49
Diodes			
D1 – 1N4001, 1 Amp, 50 V	276-1101	2/.39	.20
D2 – 1N4739, 9.1 V, 1 Watt	276-562	2/.89	.45
D3 – 1N914, signal diode	276-1122	10/.99	.10
D4 – 1N914, signal diode	276-1122	10/.99	.10
FB – Ferrite bead			.10
IC – AMI S2559B or S2559D, digital tone generator			4.65
Resistors			
R1 – 220, 1/2 W, 10%	271-015	2/.19	.10
R2 – 10 megs, 1/4 W, 5%	271-1365	5/.39	.08
R3 – 8.2k, 1/4 W 5%	271-1334	5/.39	.08
R4 – 470, 1/4 W, 5%	271-1317	5/.39	.08
R5 – 10k, 1/8 W, potentiometer	271-335		.39
R6 – 47k, 1/4 W, 5%	271-1342	5/.39	.08
R7 – 10k, 1/4 W, 5%	271-1335	5/.39	.08
SW—8 rocker DIP switch	275-1301		1.99
X1 – Ceramic resonator (see frequency chart), Radio Materials Co., Chicago IL 60646, model CR15			1.50
Printed circuit board			2.50
IC socket, 16-pin dual inline (DIP)	276-1998	2/.89	.45
	Total		$14.75

network between the outputs of the Johnson counter, V_{DD} and V_{ref}. V_{ref} closely tracks V_{DD} over the operating voltage and temperature range, and therefore the peak-to-peak amplitude V_p $(V_{DD} - V_{ref})$ of the stairstep function is fairly constant. V_{ref} is so chosen that V_p falls within the controlled range of tones.

The individual tones generated by the sine-wave synthesizer are then linearly added, and they drive a bipolar NPN transistor connected as an emitter-follower to allow proper impedance transformation, at the same time preserving the signal level. Amplitude depends upon the operating supply voltage as well as the load resistance connected on the tone output pin. The on-chip reference circuit is operational when the supply voltage equals or exceeds 5 volts, and, as a consequence, the tone amplitude is regulated in the supply voltage range above 5 volts.

The load resistor value also controls the amplitude. If R_L is low, the reflected impedance into the base of the output transistor is low and the tone output amplitude is lower. For R_L greater than 5k, the reflected impedance is sufficiently large and the highest amplitude is produced. For the values shown in the schematic (see Fig. 1), the output across R5 is adjustable to approximately 1.5 volts peak-to-peak. C6 and R6 provide dc isolation and impedance matching and should be selected for optimum performance with the connected radio.

Dual- and Single-Tone Modes

When one row and one column are selected, a dual-tone output consisting of respective tones is generated.

Single tones either in the row group or the column group can be generated as follows. A row tone can be generated by selecting the appropriate row input and two column inputs. A column tone can be generated by selecting the appropriate column input and two row inputs.

Chip Disable

The S2559B and S2559D have a chip-disable input at pin 15. The chip disable is active high. When the chip disable is active, the tone output goes to V_{SS}, the row and column inputs go into a high impedance state, the oscillator is inhibited, and the MUTE and XMIT outputs go into active states. The schematic in Fig. 1 provides R7, D3, and D4 so that the grounding point (PTT) will enable the chip. If this feature is not desired, omit R7, D3, and D4.

MUTE, XMIT Outputs

The S2559 has a CMOS buffer for the MUTE output and a bipolar NPN transistor for the XMIT output. With no switches selected, the MUTE output is low and the XMIT output is in the active state so that substantial current can be sourced to a load. When a switch is selected, the MUTE output goes high, while the XMIT output goes into a high-impedance state. When chip disable is high, the MUTE output is forced low and the XMIT output is in active state regardless of the state of the switch inputs.

Outboard Regulator

The outboard regulator is composed of R1, C1, FB, D1, D2, and C2. Resistor R1 is used to limit current and keep the voltage regulating zener diode, D2, within safe operating limits. Diode D1 provides reverse polarity protection as well as combining with D2 to make the regulator circuit inactive unless the input is greater than 9.8 volts. Capacitor C1 and ferrite bead FB are for RFI suppression; capacitor C2 is the filter capacitor. A voltage greater than 10 volts should be connected

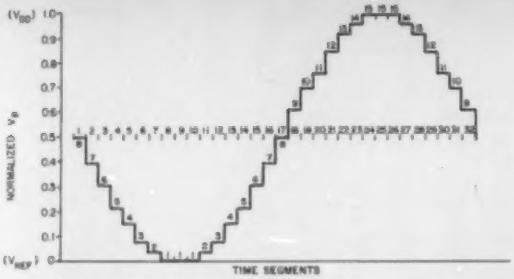


Fig. 4. Stairstep waveform of the digitally-synthesized sine wave.

67.0	97.4	127.3*	186.2
71.9*	98.1 N*	131.8*	188.0 N
74.4	100.0*	136.5*	192.8
77.0	103.5*	141.3*	203.5
79.7	107.2*	146.2	209.0
81.0 N	110.9*	151.4*	210.7
82.5	112.7 N*	156.7	218.1
85.4	114.8*	162.2	225.7
88.5*	118.8	167.9	233.6
90.0 N	121.0 N*	169.0 N	241.8
91.5	123.0	173.8	250.3
94.8	124.0 N	179.9	

*Fig. 5. EIA and other CTCSS tones. N = not EIA tone; * = tones listed in repeater directories.*

between points (+) and (−). A voltage less than 10 volts (i.e., from a 9-volt battery) should be connected between points (B) and (−).

Notes

The tone must be inserted after the modulator audio filter—most likely at the deviation control. (Be sure to match impedances.)

The audio level control, R5, should be adjusted to produce 0.5-kHz to 1.0-kHz deviation.

The encoder should be switched on or enabled only in the transmit mode. This can be done by applying power to (+) or (B). By utilizing the chip-disable feature, point PTT can be connected to the push-to-talk switch and power can remain constant while the radio is turned on.

CTCSS tone generators cause a problem in some synthesized transmitters. Consult the manufacturer for recommendations.

Printed circuit boards, available from R. A. Harold K8SCL, 1856 Cherrylawn Drive, Toledo OH 43614, are $2.50 each. Please send an SASE.

Frequency anti-resonant ceramic resonators have been purchased for fa = 269.14 kHz. Contact me for information regarding these. ■

References

"All About SCTS," John Franklin K6LUA, *73*, August, 1977.

"Should Repeaters Use Sub-Audible Tones?", Art Reis K9XI, *73*, July, 1978.

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S2559 A/B/C/D Digital Tone Generator, American Microsystems, Inc., 3800 Homestead Road, Santa Clara CA 95051, August, 1978.

COS/MOS Integrated Circuits Manual, RCA, Solid State Division, Somerville NJ 08876, 1972.

Repeater Atlas, *73*, 1977.

ARRL Repeater Directory 1978-79, 9th edition, 1978.

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—part I: getting there is easier than you think

As amateur radio has progressed over the years and we amateurs have been evicted from the lower frequencies for one reason or another, we have continued to operate at the higher and higher assignments until a few years ago. I realize that many hams today have gone on to the microwave regions, but usually with laboratory or commercial equipment. Very nice gear is presently available commercially, even for 10 GHz, if one can afford it!

Even 2 meters was rather barren until a few years ago when the equipment drawn out of commercial service got the FM ball rolling. Then the multi-mode imports added the CW-AM-SSB language back to VHF, as it had been heard on the lower bands. There, all seems to have stopped again! Only the crowded conditions of 2 meters and the persistence of some ATVers seem to have "pushed" us into trying 450 MHz. As far as 1296 MHz goes, it is 90% forget-it. It is either limited activity with antique gear and modes or full-blown efforts at EME with gear straight from microwave laboratory environments. The following reasons sparked me recently to give it a whirl—one more time.

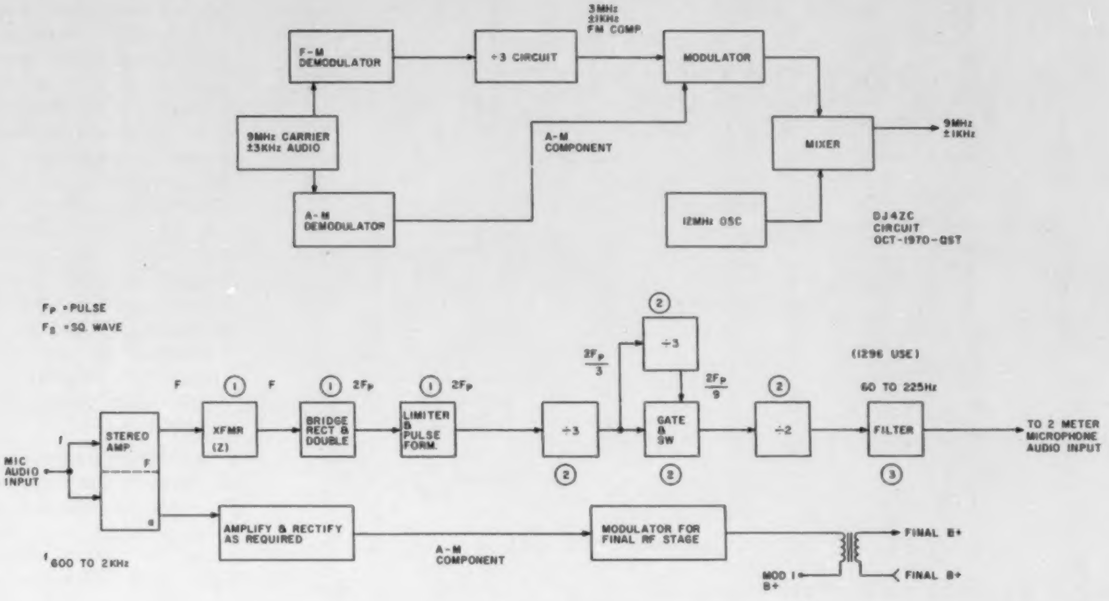
1) I was lucky enough to get on 1296 MHz over 10 years ago in an area of the country where it was then popular. Modulated APX-6 surplus military gear ruled the roost, and the biggest technical debate seemed to be, do I demodulate the received signal as AM or FM? The rig's characteristics were such that few hams really knew which they were sending, and even fewer of them cared! FM won, by the way.

2) Being familiar with the price versus quality (low vs. high) of the APX-6, and knowing that many were still around, led to my trying to overcome the contempt I formed of them 10 years ago. The contempt was mostly over the mechanical modifications required, and not over the electronics. At 1296 MHz, it is a "plumbing" world until someone comes up with a better idea. I am *not* a mechanical genius, and I have the disgust for mechanical things to show for it. In fact, in electronics I am only an expert (i.e., x = an unknown quantity; spurt = a drip under pressure!). With any attack I make on something I make or design, you can bet on an electronic approach.

3) Whatever I came up with had to be cheap—or at least inexpensive—so that I could interest others. This was from both an article standpoint and, equally important, so that I could get some local 1296-MHz population to talk with!

I believe that this article just might awaken an interest in trying out 432 and 1296 MHz, because it is based on sound and easily-proven facts. Those facts are:

- There is a fast-growing group of hams who own multi-mode or, at the least, FM 2-meter rigs in the 1-to 10-Watt category. That meets requirement one for my scheme.
- Many recent articles have been about small, light, high-gain antennas that can be built at home cheaply and effectively. Requirement two, that you need a good antenna, is met!
- A cheap means of getting from 2 meters to at least 432 MHz does exist, and in nearly ready-to-use shape. Don't panic for now about what tripling does to the modulation, OK? So much for requirement three.
- The APX-6 is an obvious answer to get from 432 to 1296, but the nearly ready-to-use item I chose turned out to be a commercial FM rig of the GE, RCA, or Motorola type, in my case, a Motorola T-44. Only the transmitter strip need be bought ($10 or less at hamfests), and then only the two box assemblies that are the 2C39 tripler (144 MHz to 432 MHz) and the 2C39 final are used. The latter is turned into a tripler itself in 1296-MHz use.
- Some scheme of modulation (beyond the obvious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÷3 CIRCUIT
3MHz ±1KHz FM COMP
MODULATOR
9MHz CARRIER ±3KHz AUDIO
A-M COMPONENT
MIXER
9MHz ±1KHz
A-M DEMODULATOR
12MHz OSC
DJ4ZC CIRCUIT OCT-1970-QST
Fp = PULSE
Fs = SQ. WAVE
MIC AUDIO INPUT
f
STEREO AMP.
F
f
F
①
XFMR (Z)
F
①
BRIDGE RECT & DOUBLE
① 2Fp
LIMITER & PULSE FORM.
① 2Fp
÷3
②
2Fp/3
②
÷3
GATE & SW
②
2Fp/9
②
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A-M COMPONENT
MODULATOR FOR FINAL RF STAGE
FINAL B+
MOD I B+
FINAL B+

Fig. 1.

one of CW) which can be handled during frequency multiplication is required, and I'll cover that first.

In order to prove out my point on the modulation scheme, I refer you to an excellent construction article that seems to have slid right by present VHFers' notice. It is by Karl Meinzer DJ4ZC, and appeared in the October, 1970, *QST*. If you can imagine putting just old AM modulation on the original 2-meter signal and tripling twice to get to 1296 MHz, the results are understandably horrendous. If I may, I will quote from Karl's article one full paragraph that says it all better than I could.

"It is well-known that conventional frequency multiplication results in distortion of an amplitude modulated signal." (That's for SSB as well—author.) "Frequency multipliers are usually class C amplifiers, which have a non-linear relationship between the input and output voltages. The third harmonic of an amateur AM signal may be readable enough, though somewhat distorted, but the complex nature of sideband (which is really AM of sorts) makes the signal unintelligible after multiplication in conventional stages."

The author goes on to describe a quite workable system that begins by modulating a 9-MHz carrier, then demodulating the FM and AM portions in separate channels, dividing the FM channel by 3, combining the AM component back in through the use of the new 3-MHz carrier frequency, and then mixing against a 12-MHz signal to get back to 9 MHz. What he has, as his diagram in Fig. 1 shows, is (FM/3) + AM at 9 MHz. Anywhere that this is again tripled (as in the transmitter class C tripler), the original modulating tones or audio reappear.

I had been working on a scheme for two years when this appeared, but for quite different reasons. My moonbounce interest goes back further than that even, and I had concluded that I would have to run CW or come up with a narrowband (*very* narrowband) voice system in order to run very narrow bandwidths in the receiver and reduce the system noise problem. I thought, with all the TTL ICs just then appearing, that this would be my method. I would divide down the voice (only at baseband audio, in my case) so that a 300-to-3000-Hz voice band, when divided by 10, would become a 30-to-300-Hz band. The problems arose when I tried to figure out a way to reverse what I had done to straighten it out on the receive end. It should all work at baseband audio, so that no station equipment modifications would be required.

Karl's article really sparked the way to go for me. By taking the speaker audio (original audio frequencies divided by 10, sent, and received) and using it to modulate a 50-kHz carrier (using old surplus receiver coils such as are used in some Q-multiplying operations) and multiplying in an i-f with class C stages up to 500 kHz (modified 455-kHz cans), the original audio was back. In short, it worked—great!

I got sidetracked due to new job traveling at that point and could never quite settle the legal aspect of whether this might be thought by the FCC as being encrypted (illegal) transmission on the amateur bands. An STA from them was never sought. All work was noted, filed, and forgotten until recently. I even discussed at the time whether or not just tripling twice, sending it at baseband (but using class C finals), and dividing it down at the receive end would be a valid idea except that the bandwidth (at 1296 MHz) would be wide (i.e., 3 kHz is 3 x 3 x 3, or 27 kHz wide at the frequency of transmission, assuming 2 triplers in class C operation).

My recent work on just getting a carrier on 1296 MHz for a bit of fun this winter reawakened the modulation ideas. Sure enough, it all seems to work on QRP, VLF, test-bench setups, and on paper.

Fig. 1 shows Karl's scheme and also mine. The ideas are similar, but just a little different approach is taken. The system is not hi-fi or without bugs, but I will point out where they are and where I think the system is now totally sound. In Fig. 2, the audio system is

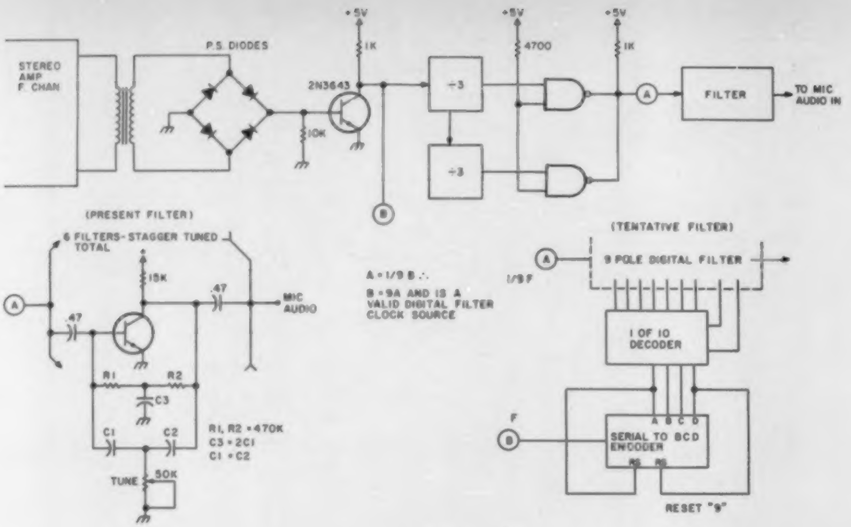

Fig. 2.

efficient and can be made quite inexpensively by using available components. Audio amplification is handled by a small, 1-Watt stereo amplifier. It uses transformers to match the outputs of the amplifiers used, and the split controls allow you some degree of alignment or adjustment.

The gain of the FM channel should be set to produce square waves or hard-limited sine waves at the amplifier output over the range of 300-to-3000-Hz single-tone inputs. The AM channel gain control becomes an AM gain, or modulation level, adjust. It should be set to produce a dc output level that is proportional to the amplitude of the tone input and at sufficient level to re-modulate the AM component back onto the constant-amplitude divided audio at the last audio stage.

The only item which needs more testing in the audio circuits before attempting on-the-air tests is the low-pass filter after the FM divider. Since reams of literature are available in all the amateur magazines and handbooks on "divide-by" circuits for TTL, some CMOS, etc., I have shown the entire scheme as a block diagram and provided details where needed. The low-pass filter is now a group of 6 "twin-T" single transistor filters which are somewhat broadbanded and overlap over the new voice bandwidth (600 Hz to 2000 Hz reduced to approximately 60 to 220 Hz). This is not very expensive, but there must be a better way!

LC filters are not a good choice as they ring too much. Digital filters may be the answer as they have a nice variable bandwidth and a frequency set by a factor of the filter poles and the clock input frequency. Some thought is being given to using a digital filter having 9 poles and the original amplified, rectified, but not filtered FM component frequency as the clock. We are still working on that one, but, meanwhile, the "T's" do work.

The above produces audio divided down in such a way that the output is a square wave (filtered to sine wave) at one-third or one-ninth of the original frequency. If this is applied to a 2-meter transmitter just as microphone audio would be, the result would be a 2-meter signal with divided-audio modulation on it. Unfortunately, using TTL dividers to divide by 3 or 9 results in an unsymmetrical output—not a square wave, but this is easily overcome using some simple power supply theory.

The output of the audio amplifier module encounters a matching transformer. In both of my channels, I used 500-Ohm-to-16-Ohm output transformers installed backwards (16-Ohm side to the amplifier output), and they worked fine. Feel free to try what you have before you go buying anything.

The transformer then connects to a full-wave bridge, which is the quickest and easiest way to double an input frequency that I know of, and it yields just the waveform that is needed for the next stage. The next stage is just an inverter, but it uses the "off" period of the transistor to produce a fairly narrow pulse whose width is equal to the short time the transistor is off. By putting the transistor collector reference up to +5 volts, a TTL-compatible pulse is also produced.

A pair of divide-by-2 ICs follows next, but they are rigged to divide by 3. This is the take-off point to feed the last divide-by-2 stage if you are going from 2 meters to 432 MHz. Otherwise, the signal goes on to another divide-by-3, and on to the divide-by-2 for 1296-MHz work. The whole idea is shown by the following example using a single 2700-Hz tone and 432-MHz end frequency: Double the 2700 Hz in the full-wave bridge to 5400 Hz, divide by 3, which produces 1800 Hz in the divide-by-3 circuit, then divide by 2 to 900 Hz. The result is 2700 Hz divided by 3, but the output is a square wave.

Try the same example for a 1296-MHz end frequency: The 5400 Hz achieved from the doubling action is divided by 3 to 1800 Hz, divided again by 3 to 600 Hz, and sent through the final divide-by-2 to produce 300 Hz. The result is 2700 Hz divided by 9, but with a square-wave output!

When this modulation is applied to a 2-meter signal, the new signal is a 2-meter carrier with modulation consisting of divided-by-3 audio (for 432-MHz use) or divided-by-9 audio (for 1296-MHz use). The 2-meter signal is then multiplied in a class C amplifier tuned to 432 MHz in the output and a 432-MHz signal with the original audio (using divide-by-3 audio in) results; triple again to get 1296 MHz plus or minus the original audio (when the divide-by-9 audio is applied to the 2-meter starting point).

What all of this means is that class C amplifiers (used as multipliers) can be run from 2 meters on up. Varactors can be used to multiply up to 432 MHz or 1296 MHz, if you are stuck on using solid state. Varactors are efficient and no extra parts or power supplies (regulated-type screen supply, etc.) are required to operate on UHF, where everything gets hard to tame or work with.

Since the length of this article kept growing, due to the construction of the audio portion and explaining what may be a whole new modulation scheme, and there are yet the T-44 transmitter and APX-6 to deal with, I have decided to break the article into two parts. Part 2 covers the T-44 and APX-6 modifications (which are not as complicated as the original APX-6 articles) and a few band plans and idiosyncrasies of this system—such as FM use. In the meanwhile, you can build the audio portion and even completely check it out by using single tones in place of voice.

If the point marked "voice audio out" is fed to an audio amplifier and a 2700-Hz tone is fed to the stereo amplifier, a clean 300-Hz tone should result out of the speaker (divide-by-9 mode). By varying the AM channel gain, you should be able to find a point where the output level is clearly proportional to the input. Keep the tone controls in both channels the same to avoid any phase errors caused by RC roll-off. You may want to run bass boosted and treble cut to help the final amplifier handle the new 60-Hz end of the 60-to-220-Hz band. You can make final adjustments on that later to compensate for the stereo amplifier you use, your own voice characteristics, or other small errors that may creep in—just like with a new rig or microphone.

That really is all there is to the audio section, and it is really cut and try, or twist and turn, once you have it all rigged together. You can get your best evaluation of lost bass response and the like by staying with single tones at first (i.e., 600, 800, 1000—up to the 2700-Hz point). Get your audio going, and we'll get it on the air in Part 2.■

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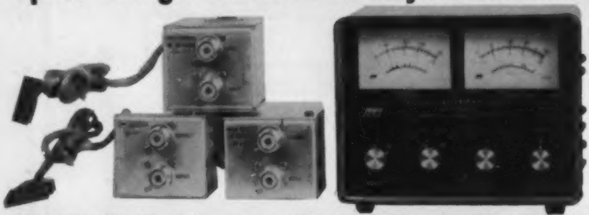

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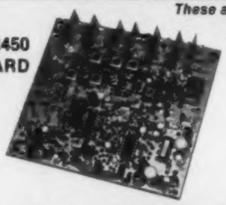

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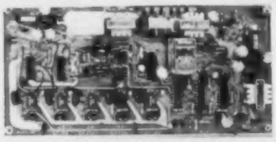
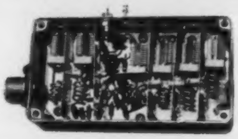


SCAP Autopatch Board
- Provides all basic autopatch functions
- 3 Digit Access; 1 Aux. On/Off function; Audio AGC; Built-in Timers; etc.
- 0/1 Inhibit bd. also available.
- Write/call for details and a data sheet.

RPCM Board
- Used w/SCAP board to provide "Reverse Patch" and Land-Line Control of Repeater.
- Includes land line "answering" circuitry



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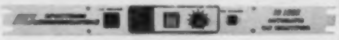

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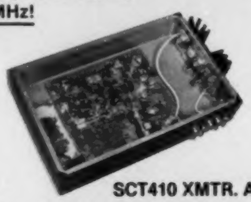

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- 7, 10 or 30 Wt. unit.

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- Similar to SCT110. 8–10 Wts.
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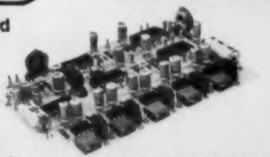

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- 3 digit ON, 3 digit OFF control of a single repeater function. Or, (optional) 2 functions (2 digits ON/OFF each).
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Over There

— notes from Kilroy

The US Army made me a radio ham, although that was not the intention. When they drafted me in 1941, before the shootin' began, they somehow had me pegged as a supply clerk, but I was not about to become a shopkeeper in uniform. Fortunately, all of this happened in a Signal Corps Battalion in South Carolina, and my request for a transfer to the Radio Section was finally approved—especially after I lied about all the radios I'd built before coming into the Army. Well, it was partly true: I had gotten one radio to work.

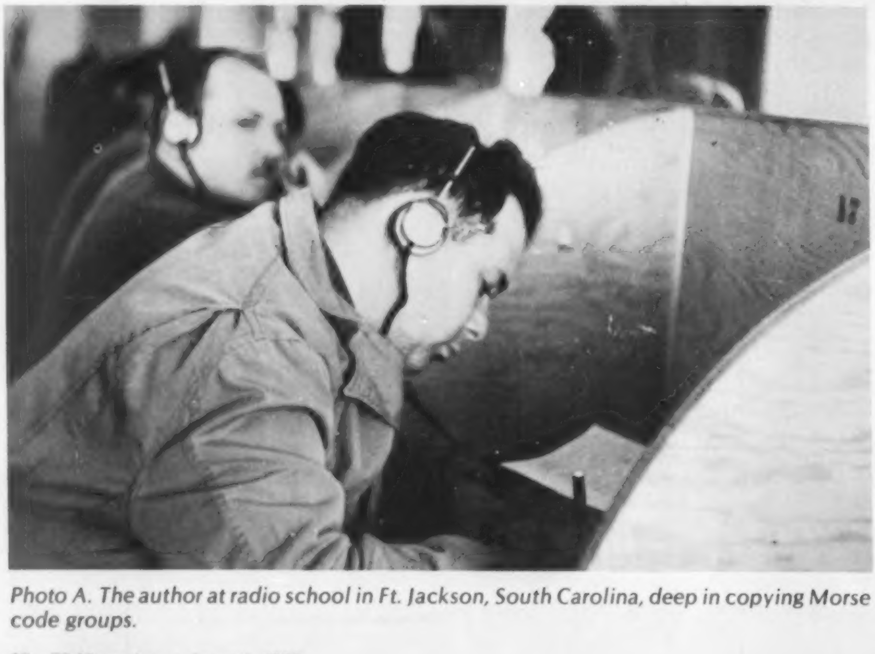

Photo A. The author at radio school in Ft. Jackson, South Carolina, deep in copying Morse code groups.

When I hear amateur radio newcomers talk now about how hard it is to learn code and theory, I smile a little. It was not hard for me — I just put in four or five hours a day, every day for three months, and I knew all that I needed. I was lucky. The Radio Section of the 56th Signal Battalion was composed mainly of hams, all of whom were very helpful. We spent many an evening around a BC-342 receiver listening to amateurs send CW on the 7-MHz band (then, 7 megacycles), and I picked up amateur procedure that way. But then the shootin' did start, and I did not get my ham ticket until I came back home in 1945.

I wound up in Algiers at Allied Force HQ as a radio operator. On the first night, they put me at a receiver and told me to copy what was coming in. The other end of the circuit was, they informed me, Casablanca. Casablanca! Was Humphrey Bogart at the key? Whoever he was, he was a little too fast for me, so I sent the Army Z signal for QRS—"send more slowly." No response. I tried again. More speed. Then he cut back to about 5 wpm and sent in clear text: "Put the radio chief on."

I called the officer in charge, who sat down and shared the phones with me. Still in clear text, and still at 5 wpm, came the message: "Put a real operator on." The lieutenant took the bug (a Vibroplex automatic key) and ripped off a string of Morse that I could not read. "You won't have any trouble now, OM," he said. Another ham! And he was right. I worked the Casa circuit for weeks, and as my code speed came up, it actually became fun.

Photo B. Livestock on the desert was a little different from that at home, as the half-track driver discovered.

But working radio out of a main headquarters in a big city, while it had its advantages, was not my idea of being an Army radio operator. In a very foolish moment, I asked for a transfer and got it — to the First Armored Division, where I was put at a radio in an armored half-track and sent Morse with a key clamped to my thigh.

I was Net Control for a Combat Command, a small, highly-mobile unit of the Division. One of the ways we confused the enemy (and ourselves even more) was to change net frequency each midnight. This meant tht I had to get everyone zero-beat to the new frequency, which took at least an hour, during which all the radio operators in the whole German Army were saying to one another, "Vell, ve see that Jablin is now on 2.345 megs tonight."

Some of the operators in the net had very little experience, and the fellow in the Ordnance Company was getting his training "on the job." One night, after all stations had checked in on what was approximately the frequency, he came back to me and asked for a signal report. I gave him a 5 by 5 — strong and readable. Then he came back on phone and confessed that he really did not know how to load up a BC-191 transmitter.

Right then and there, a few miles from the enemy line, I instructed him about tuning a transmitter using the final plate meter. Then, unthinking, I joked: "If you don't think that you're getting out, hold the key down and touch the base of the whip antenna."

He must have tried it as soon as I told him. You never heard such vile language on the air! The BC-191 ran about 75 Watts in and about 25 Watts to the antenna (not efficient, but reliable), and I'll bet that he had a blister on his finger for a long time.

The German Army (and we, I guess) had radio intelligence sections which tracked down the other side's transmitters for one reason or another. I discovered one of the reasons one night on the North African desert. Every time that I made a transmission, a few 88mm shells dropped nearby. Pretty soon I got the connection and gave up the radio until we moved to a new location.

Come to think of it, we must have had *some* kind of radio intelligence. One of the operators at Allied Force HQ in Algiers just could not get along with his fellow GIs, his officers, Army regulations, or Algerian wine, so they shipped him up front. Somehow, in the middle of the Algerian nowhere, he found a bottle of wine, which inspired him to retune his radio to an Algiers frequency which he'd remembered and send a personal message to his old CO, asking his forgiveness and a transfer back to AFHQ. Someone intercepted him and he did get back to Algiers, but as a prisoner. The Army was stuffy about that sort of operating.

All of the radio equipment that I used during World War II was tunable; we had little crystal-controlled operation except for some mobile FM stuff. By today's standards, signals were broad and not terribly stable. This meant that the CW note was not especially pleasant to hear, but if transmitter and receiver were reasonably close in frequency, solid copy was possible.

The combination I used most was the SCR-193. This consisted of a BC-312 receiver (still to be found at hamfests) and a BC-191A transmitter, plus associated antenna tuner, dynamotor power supply, etc. The 312 was a superb receiver for its time. Its main drawbacks were a bad case of backlash in the gear-driven dial, an occasional drifting local oscillator, and its weight — about 200 pounds, it seemed, when you were trying to wrestle it into or out of its mounting.

The 191A was another kind of beast. It was a basic "Master Oscillator-Power Amplifier" rig (MOPA), a circuit which had been popular with hams for many years before. "Master Oscillator" was 1930s lingo for a vfo, preferably one with the instability built in. When you keyed it on CW, the oscillator gradually came up to frequency to make a dot or dash, then dropped right off, giving the Morse a very distinctive "yoop" sound. Amateurs who tried to put the 191 on the ham bands after the war quickly heard from the FCC. The PA had, as I mentioned, about 75 Watts input. This often was loaded into a whip which physically or electrically had no reference to the operating frequency. We did the best that we could with the antenna tuner, which often worked.

The SCR-193 could be mounted in a jeep, a truck, a tank, an aeroplane, or, with an ac version of the receiver, it could be fixed. That is why I saw so many of them.

We "field radio operators" were not supposed to do much maintenance; changing tubes and lubricating dynamotors were all that the regulations permitted. When something went really wrong, we were supposed to send the radio back to "second echelon," which had its own limitations on what it was supposed to do. No one paid much attention to all of this. If you thought that you could fix it and you had the time, you tried. We had the manuals which came with the equipment, but many of us used the *Radio Amateur's Handbook* as our basic reference.

To this day, I hate to use earphones, for a very funny reason. We had our halftrack at a forward observation post and I was operating from outside the track, using the phones and key on long extension cables. The phones prevented me from hearing the first mortar shells come in, and by the time I tried to find shelter under the vehicle, it was too late. A few shell fragments caught me in the leg and elsewhere, and I was away from the radio for a few months.

When the Army decided that they wanted me back at work, the North African campaign was over. I was put on a troopship to Naples, Italy. This short voyage produced one of the mysterious interludes in my Army career. About an hour after we left port, I was paged on the PA system and told to report to the Army officer in charge. He asked if I were, indeed, a radio operator, and by this time, I felt qualified to say yes. He then took me to the ship's radio shack and sat me in front of a receiver, with orders to listen for signals, to copy anything I heard, and "don't touch the tuning!"

I sat there for a whole week, except for meals and sleep, when I was relieved by another operator. And I never heard a thing.

In Italy, I spent some time in a replacement depot while the Army lost my records and found them again. When my papers did show up, I discovered that I'd been reclassified "Field Radio Operator and BAR (Browning Automatic Rifle) Gunner." I'd never seen a BAR, and to date I have never used one. But — if the need should arise — I am qualified. The Army says so.

After rediscovering the fact of my existence, the officers in charge of my life put me on a truck and sent me north toward the action. The truck stopped at the 120th Engineer Combat Battalion and a lieutenant with a clipboard called my name and serial number. I looked around at the bulldozers and other heavy equipment and said, "Sir, there must be some mistake. I'm a radio operator, not an engineer." He checked my name and number again. "Well, Jablin, you're an engineer now."

On the way to Battalion HQ, I passed a jeep and saw an SCR-193 mounted in it. I was home again!

Combat engineering had its own light moments. I was the operator of the jeep radio; we used the car for reconnaissance and other general errands. Mainly, we chased around Italy and (later) France, looking for blown bridges, mined roads, and other hazards to health—except for the four months that I sat in a hole on Anzio doing nothing.

Actually, one never did "nothing" in the Army. Our S-2 (battalion intelligence officer) had an inordinate affection for explosives and believed that every soldier in an Engineer Division should share that love. Therefore, he filled our idle Anzio days with classes in how to use TNT, dynamite, black powder, and all the rest — how to make boobytraps and how to defuse them, and what a shaped charge is and how to blow a bridge with one. Life was one great Fourth of July.

Then I discovered that mine detectors were considered radio equipment (they had batteries and tubes) and part of my job

Photo C. This was the 1941 model of an ATV—All-Terrain Vehicle—complete with SCR-193 radio, 30- and 50-caliber machine guns, armor plating, and a canvas top to keep out the rain . . . in the desert.

Photo D. No matter what the locale, a GI haircut was part of the Army uniform. The spots on the photo are from sand which got into the developing tank. Film was processed in a small tent at night.

Photo E. The SCR-193 was mounted behind the front seat of this Command Car, and the whole rear compartment was the "radio shack." The rig got a good workout during maneuvers in the Carolinas during the summer of 1941.

was to keep these gadgets working. If you've ever read the catalog description of a Heathkit metal locator, you know the general principle behind mine detectors. Later models, designed to locate non-metallic mines, worked like VHF grid-dip oscillators. The men who swept roads and fields with these devices gave me frequent invitations to come along and watch them work, the philosophy being that it must be very interesting for me to see them use the equipment I'd worked on. It was interesting, but if I turned such invitations down, the response was likely to be: "Don't you think that you did a good job fixing this damn thing?"

So, the radio communications was mixed with a good deal of military engineering.

The other operators in the battalion did not share my preference for CW, and therefore we used phone most of the time. This led to some interesting voice communications (very much against Army rules) when we used slang or obscure references to avoid the trouble of encoding messages.

The jeep was laid up one day and my company moved ahead, leaving it in a French barn — and me to keep an eye on it — until a repair part could be brought back. As evening fell, there was a knock on the door and a Frenchman stuck his head in. "Monsieur," he said, "Des Allemands sont arrivés (The Germans have come)." Great! I was the only GI left in town. "How many?" I asked, continuing in French. "Nine," was the answer.

The odds were nine to one, and no matter what the magazine stories said, I didn't believe that one American (me) was a match for nine Germans. I got on the radio, and the heck with military procedure. Without any preliminaries, I began right after pressing the mike button: "Do you know who this is and where I am?" My buddy at Company HQ recognized my voice and remembered that I'd been left behind; he gave me an affirmative. "Some of Walter's cousins have dropped in for a baseball game up the road . . . want to join in?" I continued. Walter was one of the radio ops. He was of German extraction, and we used to kid him about the German Army being full of cousins of his.

The other operator got the message. "I'll tell Uncle Bill and we'll be along," he said. "Over." Uncle Bill was Major Williams, the Exec Officer. Shortly after, a GI truck drove up with several soldiers from HQ, along with Uncle Bill. Actually, no fight developed. The Germans were tired, cold, hungry, and very much in a mood to surrender. But I was glad that I'd had the radio.

Uncle Bill came to my rescue another time, too. Our battalion was to put an assault pontoon bridge across a river under cover of darkness, and as soon as night fell, the trucks loaded with boats drove toward the shore. Motors shut off, they silently coasted the last mile or so down a hill. They were followed by my jeep, driven by a brand new reconnaissance officer fresh from the States.

"Send HQ a message and tell them that we're here," he ordered me.

Now, the dynamotor on the SCR-193 made a fearful racket when it was turning over, and when the transmitter key was hit, the load made it whine like a siren.

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"Lieutenant," I said, "There's a whole woods full of Germans on the other side of that river and they don't know that we're here yet. If I use the radio, they'll know that something is going on. Besides, HQ knows that we are here — they sent us."

"Soldier," he told me, "I'm ordering you to tell HQ that we have arrived on the scene."

I stuck with it. "Lieutenant, I'll walk back to HQ with the message, but I'm not touching the radio." At that point, construction began on the bridge and he had to supervise something or other. "We'll continue this later," he promised.

When the bridge was completed (the Germans were awfully surprised), we drove back to Battalion HQ and I headed for my sleeping bag. "Just wait a moment," the lieutenant told me. "We are going to see the Executive Officer." We entered the CP (Command Post) tent and he told Major Williams that he was going to prefer court-martial charges against me. "Hold on, son," said the Major. "Don't use that word so fast. Jablin, what happened?"

I told him the story, including my offer to carry a message back on foot. Uncle Bill thought for a while.

"Lieutenant," he finally said, "you've just arrived here. A lot of us have managed to live through this thing for a long time, and I reckon that you want to survive, too. If you intend to stay alive to get back home, you'd better listen to some of the men who have had the experience."

The lieutenant and I became very good friends, and I occasionally let him use the radio himself. ■

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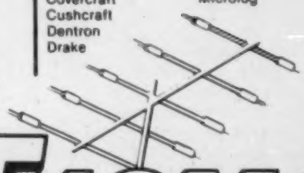

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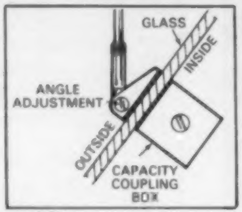

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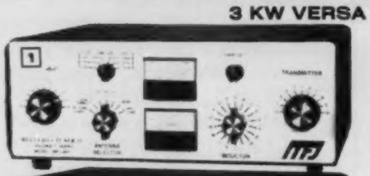

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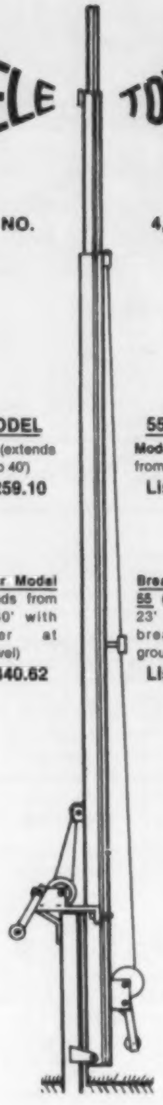

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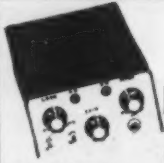

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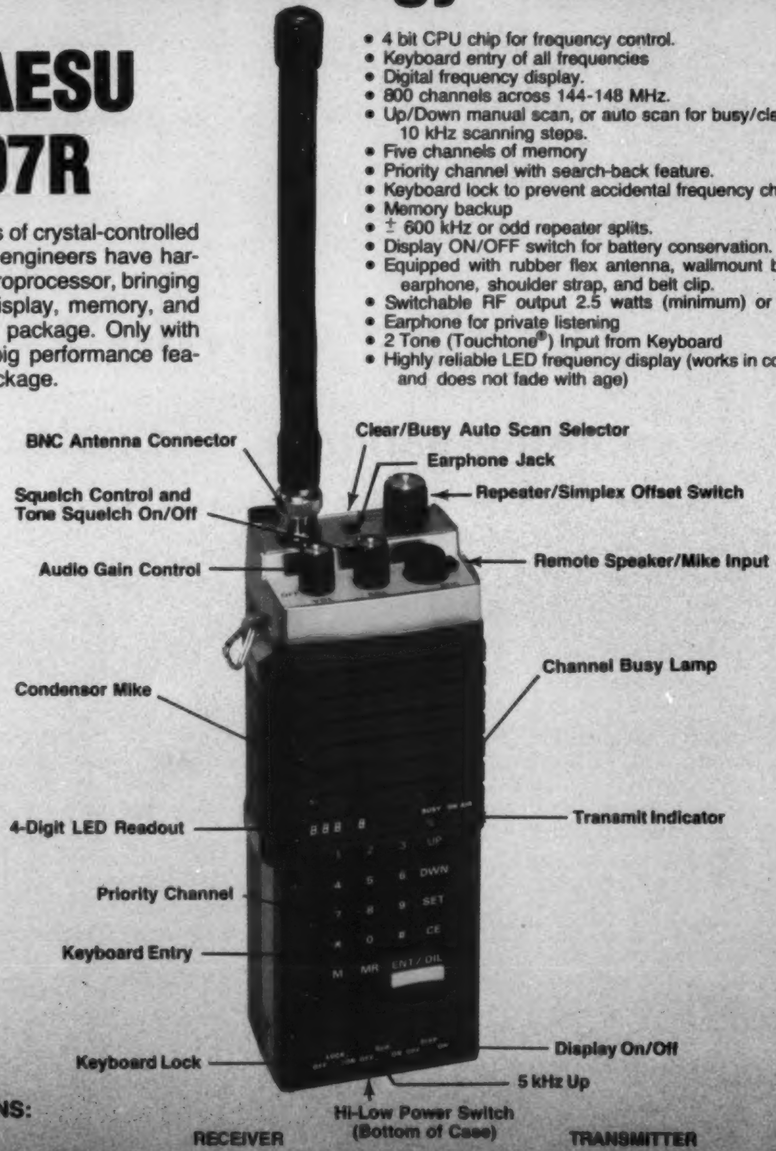
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Display On/Off
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SPECIFICATIONS:

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Number of channels: 800
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The thrill of being on the other end of a pileup from an exotic spot is the dream of any ham who has ever tasted DX. While most just dream about it, we did it!

"We" means myself and a few local ham friends. Probably the hardest part is convincing the XYL to let you go. We found the best way to achieve this is to let her visit her mother, since she would not enjoy the hour after hour "on-the-air" routine of a DXpedition.

Photo A. A sample of the excellent wood carvings of Belize. The dark, mahogany-like wood carvings made wonderful souvenirs for the DXpedition crew. Here, Rodger K4BKK/VP1RS poses beside the "Goliath" being carved.

Our first spot was chosen when, during a contact on 20 meters one evening, Norman VP1KT in Belize suggested that we visit him. He coordinated all the license paperwork and before you knew it, I was VP1RS. Loren W4YU became VP1DX, his son, Mike WB6SJD, became VP1MM, and Erv K4HEM became VP1EF. Norman even arranged, through the hotel assistant manager, for us to be able to erect two antennas on the roof of the Fort George Hotel in Belize City.

From the moment we arrived, finding Norman at the foot of the steps coming off the plane, to the frantic climbing about on the roof erecting the antennas, to the nonstop beer drinking (we were afraid to drink the water), to the hour after hour of endless pileups (total: 2500 contacts, SSB and CW), to the local sightseeing and buying Zaracote wood carvings, to the fright of almost missing our plane back, it was four solid days of excitement, and anyone who heard us on the air could tell we were having the times of our lives. We called ourselves the Tunnel Radio DX Club (after my business) and our QSL manager (Phil WB4INC) was still getting cards over a year later. That was July, 1978, and we thought we had worn out the excitement of DX.

That was until the spring of 1979, when Erv and I decided to do it again. Loren and Mike, having other commitments, were sorry they couldn't make it again. We started searching the globe for some exotic spot . . . maybe an island? We chose Sint Maarten since it counted as a separate country from the rest of the Netherlands Antilles. An over-the-air contact with PJ2AAX got his cooperation in aiding with the license paperwork. As it turned out, our applications went to Curacao, the capital, then were sent to Sint Maarten for the signature of the Governor there, and then went back to Curacao for the signature of the Governor there. This process normally can take as long as six months, but with the help of John PJ2AAX and Fred PJ2FR, we got the final signature on the morning we were to depart for the island.

K4BKK/PJ7
K4HEM/PJ7

Photo B. Tunnel Radio DX Club DXpedition to Sint Maarten Island (PJ7), July 11-15, 1979. Left to right: Rodger K4BKK/PJ7, Erv K4HEM/PJ7, and Dee VP2EEK, who dropped by for a visit to the operation.

Since local calls are not issued to visitors anymore, I became K4BKK/PJ7 and Erv was K4HEM/PJ7. We were quite shocked that upon arrival at the hotel where we had made reservations, nobody was there! Sitting on our suitcases in the sand, with the mosquitoes biting, we came close to panic. Fortunately, we found a guest in one cottage who drove us down the road to a most beautiful resort, the Caravanserai. We settled into a studio apartment complete with kitchen. (Now, *this* is the way to operate!) Soon after checking in, we sought out the assistant manager and explained our situation. He, being an understanding chap, gave us permission to string two trap dipoles between the palm trees out back. It was after midnight when we tacked up one dipole six feet off the ground only to find that only a few stations could hear us that evening. Being tired from traveling, we hit the sack with the idea of getting up early to erect the antennas.

6:00 am found Erv trying to cast a line with his fishing rod over the top of a palm tree. Three casts, and three times caught high up in the tree. I finally tied the line around a rock, hurled it over that and two other palms, and the antennas were up.

Both antennas performed fine—one was donated by Bassett Antennas and the other by Bing W4IB. Like kids in a candy store, the next few days were filled with hour after hour of pileups. A contest that hit that weekend stole some of our fire, since we kept getting covered up by contesters.

That, and those few times when the bands were lousy, gave us time to sightsee. We visited Phillipsburg, the capital of Dutch Sint Maarten, and found some real bargains in the duty-free shops. The binoculars I purchased came in handy during a visit to a nude beach on the French side of the island (FS7-land).

Between the pileups, the immaculate beaches, the nightlife at the casinos, and the friendliness of the locals, it was another vacation/DXpedition we'll remember for a lifetime. As for 1980, who knows where you'll find us? Keep listening! ■

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A Soft Approach to Logging

—electronic data base management for hams

The amateur exploring uses for a microprocessor in the ordinary pursuit of his hobby will find the possibilities almost endless. It seems likely that in the not too distant future, all amateur equipment will come complete with microprocessor. Most applications will involve some form of process control, but not all. Many amateurs have found that these midgets are well suited to encoding and decoding CW and RTTY signals. As new uses are invented, there will be scores of articles describing them.

In contrast to process-control applications, microprocessors—particularly those which are general purpose—lend themselves well to indirect support. Numerical solution to problems such as filter or antenna design is one example. Record keeping, such as through a logbook, is another. It is my purpose here to examine the record-keeping application. I hope that a number of questions concerning applicability and feasibility will be answered for the initiate.

A logbook, very simply stated, is an information-retrieval system. Unlike financial accounting, which also is information retrieval, it requires little, if any, numerical manipulation. It is merely a convenient methodical way of storing strings of characters. Meaning and interpretation is the responsibility of the user. The value of a log is in its availability for recovery of historic data. A principal drawback is in the time and effort needed to build and maintain the data bank.

From the standpoint of actual cash outlay, the amateur log may well be the least expensive functional item in the ham shack. A pencil and one ARRL log, at the cost of about $1.50, should be good for a year of average operation. If this is true, why consider any large investment for a substitute? Each individual must find his own answer to this question.

There have been several automated logbook programs written and undoubtedly there will be more. Each must stand on its own merits. Some are good, others are not. One recently-published article described a log program for a small computer. In it, the author used RAM (internal memory) for both program and log-data storage. This naive approach is, for all practical purposes, worthless. A beginner's machine could accommodate only about 30 or 35 log entries. Expanding the system to a full-blown 64K would not resolve the storage problem, even for an almost inactive amateur. It is this storage demand which virtually dictates the minimum system. It must be considered in any case, whether the system is to be manual or mechanical.

For any system, there must be first a purpose, then a need. The original purpose of the radio log, established by law, was to provide a detailed permanent record of all station activity. While the minute detail is no longer required, it is a very desirable feature. The purpose, then, is obvious.

Need will be measured individually by the desirability. A great number of amateurs have devised various methods for storing and recovering names and other information about prior contacts. This established a second—probably more important—purpose: that of very rapid search of historic data.

Next, one must decide about the log vehicle. The vehicle will be the item most affecting speed of recovery. This leads directly to investigation of the microprocessor.

In the case of an amateur log, an ARRL logbook can serve as a basis for determining just what information is to be retained. When designing a mechanical system, one does not have the freedom allowed in a manual method. First, electrical storage is expensive and often unavailable. Second, there are certain limitations inherent in the devices themselves. There always will be some conflict between capacity and speed, and, generally speaking, one or the other must be sacrificed to some extent. The system designer must determine which elements of data are important enough to keep, then he must design the form or format in which they will be represented internally and externally.

The number of records to be stored in a useful file depends upon station activity. Many operators easily will log in excess of 3000 contacts in the course of a year. Others may not exceed 300. Any general-purpose system should be designed to meet or exceed maximum stated demands. This may not always be

Program listing.

```
10 ' AMATEUR LOG PROGRAM
20 '     AMLOG
30 CLS:CLEAR500
40 DIM P$(5),W$(3),SI(10),SH(10)
50 DEFSTR S: DEFINT I
60 DEFFNA(D$)=10000*VAL(LEFT$(D$,2))+100*VAL(MID$(D$,4,2))+VAL(RIGHT$(D$
   ,2))
70 DATA "  FILE MAINTENANCE",ADD     APPEND RECORDS,MODIFY  CORRECT RECO
   RDS," OPERATING MODES",A0  CARRIER   A1 CW,A2  TONE CW   A3 AM,A3A
    SSB        A4 FAC,A5  TV          F1 FSC
80 DATA F2  AFSK       F3 FM,NFM NBFM       P  PULSE
90 FORI=1TO10:READSH(I):NEXT
100 Q$="ABCDEFGHIJKL"
110 S2="JANFEBMARAPRMAYJUNJULAUGSEPOCTNOVDEC"
120 S3="SUNMONTUEWEDTHUFRISAT"
130 S4="A0 A1 A2 A3 A3AA4 A5 F1 F2 F3 NFMP  "
140 S5="MMDDYY HHMM XXXXXX XXX XXX XXXXXXXXXX"
150 S6=" DATE  TIME  CALL  BND MOD NOTE"
160 S7="% % ## % % ## #### %    % ###MC %  % %         %   ####"
170 S8="###### #### %    % ### % % %         %"
180 OPEN"R",1,"LFILE/TXT"
190 FORI1=0TO9:FIELD1,(25*I1)ASS9,25ASSI(I1):NEXT
200 ONERRORGOTO 230
210 PRINT@12,"SELECT ONE OF THE FOLLOWING MODES"
220 FORI=1TO10:I1=79+64*I:PRINT@I1,SH(I):NEXTI
230 PRINT@848,"MODE";:INPUTSM
240 IFSM="MODIFY"GOTO 1140
250 IFSM="ADD"GOTO 1450
260 M=INSTR(S4,SM):IFM=0GOTO 230
270 M=(M-1)/3+1:A$=STRING$(25," "):D$=LEFT$(TIME$,8):D=FNA(D$)
280 CLS:PRINT@770,"YOU ARE NOW IN THE LOGGING MODE":PRINT@842,"ENTER THE
     OPERATING BAND IN MC"
290 PRINT@912,STRING$(25," "):PRINT@912,"";:INPUT"BAND";B%
300 MID$(A$,1,4)=MKS$(D)
310 MID$(A$,15,1)=MID$(Q$,M,1)
320 MID$(A$,13,2)=MKI$(B%)
330 S$="":PRINT@830,"COMMANDS ARE: LOG  LOGF  LOGL  FIND  OFF  CLEAR  ST
    OP":PRINT@912,STRING$(25," "):PRINT@912,"COMMAND";
340 INPUTS$:GOSUB 840
350 K=INSTR("LOG FIN OFF CLE ADD MOD STO",LEFT$(W$(1),3))
360 IFKON(K-1)/4+1GOTO 380  , 810  , 560  , 550  , 1450 , 1140 , 1610
370 GOTO 330
380 IFNW<2GOTO 330
390 IFP%=0CLS
400 IFP%<5GOTO 430
410 PRINT@784,"LOG TABLE IS FULL   "
420 FORI=1TO2000:NEXT:GOTO 330
430 IFLEN(W$(2))<4GOTO 330
440 T$=MID$(TIME$,10,5)
450 T%=100*VAL(LEFT$(T$,2))+VAL(RIGHT$(T$,2))
460 MID$(A$,5,2)=MKI$(T%)
470 P%=P%+1:P$(P%)=W$(2)
480 IFP%>1GOTO 490  ELSEL$=D$+" "+T$+STRING$(50," ")
490 MID$(L$,18+8*(P%-1),6)=W$(2):PRINT@64,L$;
500 IFLEN(W$(1))<4GOTO 330
510 H$=MID$(W$(1),4,1):L%=138+64*P%
520  IFH$="F"GOSUB 590  :GOTO 330
530 IFH$="L"GOSUB 600
540 GOTO 330
550 CLS:P%=0:GOTO 330
560 IFP%=0GOTO 330
570 PRINT@150,"LOG":GOSUB 980
580 GOTO 330
590 I3=0:I4=9:I5=1:I7=1:I8=LOF(1):I9=1:GOTO 610
600 I3=9:I4=0:I5=-1:I7=LOF(1):I8=1:I9=-1
610 PRINT@L%,"     SEARCHING FOR ";W$(2);
620 E$=STRING$(6," "):MID$(E$,1,6)=W$(2)
630 FORJ%=I7TOI8STEPI9
640 GET1,J%
650 FORI%=I3TOI4STEPI5:C$=MID$(SI(I%),7,6)
660 IFC$=E$GOTO 690
670 NEXTI%:NEXTJ%
680 PRINT@L%,STRING$(19," "):RETURN
690 GOSUB 730
700 PRINT@L%,"";
710 PRINTUSINGS7;G$,D1%,M$,Y%,T%,E$,P%,SX,N$,R%;
720 RETURN
730 GOSUB 1260
740 M1%=INT(D/10000)
750 D1%=INT((D-10000*M1%)/100)
760 Y%=D-10000*M1%-100*D1%
770 M$=MID$(S2,3*(M1%-1)+1,3)
780 GOSUB 1090
790 R%=10*(J%-1)+I%+1
800 RETURN
810 PRINT@586,STRING$(54," "):L%=586
820 PRINT@650,STRING$(60," "):GOSUB 590  :L%=650:GOSUB 600  :GOTO 330
830 '
840 NW=1:IFS$=""NW=0:RETURN
850 FORL=LEN(S$)TO1STEP-1:C$=MID$(S$,L,1):IFC$=" "THENNEXT
860 FORI9=1TO3:W$(I9)="":NEXT:K8=0:K9=0:NW=1
870 K9=K9+1:C$=MID$(S$,K9,1)
880 IFC$<>" "W$(NW)=W$(NW)+C$:K8=0:IFK9=LRETURNELSEGOTO 870
890 IFK8=1GOTO 870  ELSEK8=1:NW=NW+1:GOTO 870
900 '
910 K9=0:FORI9=1TOLEN(A$):
  C$=MID$(A$,I9,1):
  IFC$<>"."GOTO 930
920 K9=K9+1:IFK9<2GOTO 960
   ELSEER=1:RETURN
930 IFC$<>"+"ANDC$<>"-"GOTO 950
940 IFI9=1GOTO 960  ELSEER=1:RETURN
950 IFC$<"0"ORC$>"9"ER=1:RETURN
960 NEXT:ER=0:RETURN
970 FORB%=0TO9:LSETSI(B%)="99":NEXT:RETURN
980 GOSUB 1560
990 FORK%=1TOP%:PRINT@138+64*K%,"";:PRINTP$(K%);" ";
1000 MID$(A$,7,6)=STRING$(6," "):MID$(A$,7,6)=P$(K%)
1010 MID$(A$,16,10)=STRING$(10," ")
1020 INPUT"NAME";SN:MID$(A$,16,10)=SN
1030 LSET SI(I%)=A$
1040 IFI%<9GOTO 1060
1050 PUT1,J%:J%=J%+1:I%=0:GOSUB 970  :GOTO 1070
1060 I%=I%+1
1070 NEXTK%:PUT1,J%:P%=0
1080 PRINT@146+64*K%,"QSO LOGGED";:RETURN
1090 IFM1%>2Y1%=Y%+1900:M2%=M1%+1:GOTO 1110
1100 Y1%=Y%+1899:M2%=M1%+13
1110 J1=INT(365.25*Y1%)+INT(30.6001*M2%)+D1%+5
1120 D2%=J1-7*INT(J1/7)
1130 G$=MID$(S3,3*D2%+1,3):RETURN
1140 CLS:PRINT@15,"EXAMINE OR MODIFY RECORDS":PRINT@79,"ENTER BLANK LINE
      FOR NO CHANGE":PRINT@143,"TO EXIT SPECIFY RECORD NR 0"
1150 PRINT@270,"RECORD NR";:INPUTN%:IFN%=0GOTO1250
1160 PRINT@331,S6;
1170 J%=INT((N%-1)/10)+1:I%=N%-10*(J%-1)-1
1180 GET1,J%:GOSUB 1260 :SN=MID$(SI(I%),7,6)
1190 PRINT@390,"OLD";:PRINT@395,"";
1200 PRINTUSINGS8;D,T%,SN,F%,SX,N$;
1210 PRINT@454,"NEW";STRING$(20," ");:PRINT@459,"";
1220 GOSUB 1310
1230 IFE%GOSUB1690 :GOTO1210
1240 GOTO1140
1250 CLOSE 1:CLS:GOTO 100
1260 D=CVS(LEFT$(SI(I%),4)):T%=CVI(MID$(SI(I%),5,2))
1270 F%=CVI(MID$(SI(I%),13,2))
1280 M=INSTR(Q$,MID$(SI(I%),15,1)):IFM=0M=1
1290 SX=MID$(S4,3*(M-1)+1,3)
1300 N$=RIGHT$(SI(I%),10):RETURN
1310 E%=0:ONERRORGOTO 1440
1320 LINEINPUTA$:IFA$=""RETURN
1330 IFLEN(A$)<25GOTO 1440
1340 GOSUB1620
1350 IFE%GOSUB1690 :GOTO1440
1360 X$=STRING$(25," "):D=VAL(LEFT$(A$,6))
1370 MID$(X$,1,4)=MKS$(D):T%=VAL(MID$(A$,8,4))
1380 MID$(X$,5,2)=MKI$(T%):MID$(X$,7,6)=MID$(A$,13,6)
1390 F%=VAL(MID$(A$,20,3)):MID$(X$,13,2)=MKI$(F%)
1400 I1=INSTR(S4,MID$(A$,24,3)):IFI1=0I1=1
1410 I1=(I1-1)/3+1:MID$(X$,15,1)=MID$(Q$,I1,1)
1420 MID$(X$,16,10)=MID$(A$,28,10)
1430 LSET SI(I%)=X$:PUT1,J%:RETURN
1440 PRINT@459,STRING$(37," "):E%=1:RETURN
1450 CLS:ONERRORGOTO 1540 :PRINT@146,"APPEND RECORDS":PRINT@206,"ENTER B
     LANK LINE TO EXIT"
1460 PRINT@331,S6;:PRINT@395,S5;:PRINT@454,"ADD";
1470 PRINT@459,STRING$(37," "):PRINT@459,"";
1480 LINEINPUTA$:IFA$=""GOTO 200
1490 GOSUB1620
1500 IFE%GOTO1540
1510 GOSUB 1560
1520 E%=0:GOSUB 1360
1530 IFE%=0GOTO 1550
1540 GOSUB1690 :GOTO1470
1550 PUT1,J%:GOTO 1470
1560 J%=LOF(1):IFJ%=0J%=1:GOTO 1590
1570 GET1,J%:FORI%=0TO9:IFLEFT$(SI(I%),2)="99"GOTO 1600
1580 NEXTI%:J%=J%+1
1590 GOSUB 970  :I%=0
1600 RETURN
1610 STOP
1620 E%=0:E$=LEFT$(A$,2)
1630 IFVAL(E$)<1ORVAL(E$)>12GOTO1680
1640 E$=MID$(A$,3,2):IFVAL(E$)<1ORVAL(E$)>31GOTO1680
1650 E$=MID$(A$,8,2):IFVAL(E$)>23GOTO1680
1660 E$=MID$(A$,10,2):IFVAL(E$)>59GOTO1680
1670 RETURN
1680 E%=1:RETURN
1690 PRINT@459,"REJECTED";STRING$(31," "):FORI2=1TO1000:NEXT:RETURN

DONE
```

possible, particularly with small computer systems.

At the very least, the volume will suggest tape or diskette storage. Except for tape systems such as those with the IBM 5110 or Hewlett-Packard 9825, tape cassettes are far too slow to be useful. Disk systems vary widely in both capacity and speed. An 8-inch diskette on the IBM 5110 will hold 1.3 million bytes. The 5-inch minidisk on a single drive for the TRS-80 accommodates only about 58 thousand. Few amateurs are prepared to spend upward of fifteen thousand dollars for a hobby computer, but the microprocessor built for the hobbyist is well within reach of most. With these smaller, slower systems, the record must be carefully designed and the programs as clean as possible if recovery speed and storage capacity are important.

Design of my AMLOG system started with the selection of the Radio Shack TRS-80 as the vehicle. It was to be built around a 16K machine with at least one disk drive. It was not to require a printer. This would keep the initial investment as low as possible. Six data elements—DATE, TIME ON, CALL, BAND, MODE, and SCRATCH PAD—were selected for permanent record. By packing this into a 25-byte record, a TRS-80 system physical record could hold ten logical records. A single-drive system would allow storage of approximately 2000 lines of log. There is no magic in this design; it is simply one of several possible compromises involving capacity, search speed, and internal processing time.

A good mechanical logging system requires at least four independent processes:

- It should allow log entries concurrent with the station operation.
- The system should recover information about

```
HOW MANY FILES 1

MEMORY SIZE

RADIO SHACK DISK BASIC VERSION 2.2

READY

RUN"AMLOG/BAS"
```

Table 1.

```
SELECT ONE OF THE FOLLOWING MODES
        FILE MAINTENANCE
    ADD      APPEND RECORDS
    MODIFY   CORRECT RECORDS
        OPERATING MODES
  A0    CARRIER    A1   CW
  A2    TONE CW    A3   AM
  A3A   SSB        A4   FAC
  A5    TV         F1   FSK
  F2    AFSK       F3   FM
  NFM   NBFM       P    PULSE
  MODE_
```

Table 2.

```
APPEND RECORDS
ENTER BLANK LINE TO EXIT
DATE     TIME   CALL     BND   MOD   NOTE
MMDDYY   HHMM   XXXXXX   XXX   XXX   XXXXXXXXXX
ADD _
```

Table 3.

```
EXAMINE OR MODIFY RECORDS
ENTER BLANK LINE FOR NO CHANGE
TO EXIT SPECIFY RECORD NR0

RECORD NR 55

      DATE     TIME     CALL     BND    MOD    NOTE
OLD   022077   1620     WB2AXA   14     A3A
NEW _
```

Table 4.

```
YOU ARE NOW IN THE LOGGING MODE
ENTER THE OPERATING BAND IN MC
BAND _
```

Table 5(a).

```
YOU ARE NOW IN THE LOGGING MODE
COMMANDS ARE: LOG LOGF LOGL FIND OFF CLEAR STOP
COMMAND _
```

Table 5(b).

prior contacts as quickly as possible.

- Provision must be made for initial build-up of a data base and for appending log entries to the file in an off-line operation.
- There must be some method for locating and correcting erroneous entries.

These processes can be separated and done in two or three programs. For practical purposes, the real-time logging and search must be combined. The remaining can be in either one or two programs. However, given adequate internal storage, all can be handled by a single program. AMLOG is a single program encompassing all four processes in a command-driven environment.

General Description

AMLOG is a TRS-80-based program designed for management of an amateur radio station log. Log entries can be made in real time or can be entered later. In real-time operation, the program will, at the user's option, recall the first, the last, or both entries of an identified station. Any previously-stored record can be recalled for examination and correction if necessary. Provision is made for building the initial data base and appending records to the file offline. The program operates in a minimum 16K environment with one or more disk drives. A single drive will accommodate about 2000 log entries; two drives and the formatted diskette will hold in excess of 3000.

Stored Record

Six data elements are contained in a 25-byte logical record. The information retained is:

1) DATE—Dates taken from the internal clock or as input by way of the keyboard are in the form MMDDYY. They are stored on disk as hexadecimal. Displayed on the screen, the form is such as: WED 10 JAN 79.

2) TIME—The starting time of a contact, also taken from the clock or input by keyboard, is in the form of HHMM. It is stored as hexadecimal and may be in the time zone of the user's choice.

3) CALL—The call of the station contacted is entered as up to six characters alphanumeric. It is stored and returned as entered.

4) BAND—The operating band is represented as a three-digit value. The meaning may be coded as the user chooses or be such as 7 for 7 MHz or 21 for 21 MHz.

5) MODE—The mode of operation is a code used by the FCC. Twelve are acceptable. These are A0, A1, A2, A3, A3A, A4, A5, F1, F2, F3, NFM, and P.

6)NOTE—A ten-character scratch pad is included to be used in any manner the user desires. It is suggested that it be used to retain the name of the station operator. Since names are usually short, the pad can be used to hold some additional information.

Program Preparation

If only one disk drive is to be used, make a DOS backup, then remove all unnecessary programs. Store program AMLOG on it and run without "write protect." If more than one drive is available, the program can be stored on any drive. Put a write protect on the system disk in drive 0 and use a blank formatted disk in drive 1 for the log file. Perform the following:

1) Bring the TRS-80 up in the DOS.
2) Set the internal clock.
3) Enter the date.
4) Call the clock.
5) Call BASIC.

The appearance of the screen after entering the appropriate information necessary to get and run the program is shown in Table 1.

Program Operation

When the run is started, the clock will appear in the upper right screen. The user is prompted as shown in Table 2.

The user must respond to "MODE _" with one of the mode codes to continue. There are three major modes of operation:

1) ADD—This is used when building a new file or when appending records to a previously-established

record file. Its primary use is that of building the initial data base, but it also is used to update a file in the event that the logging was not accomplished in real time.

2) MODIFY—In this mode, the operator can recall any number of records in any sequence for inspection or for correction.

3) COMMAND—All real-time logging of contacts is done in this mode. It is invoked by a response to the initial prompting of one of the station operating modes.

ADD Mode

The ADD mode appends records to the file in the order in which they are entered. Since the log sequence is usually in time, entries should be in the same order as they would appear in a manual log. Insertion of records is not allowed. If there is a period of contacts which were not entered in the real-time operation, these should be appended before any further real-time entries are made. When the ADD mode is invoked, the program will display an entry guide and pause for operator action. It appears as shown in Table 3.

The data line is position-oriented so that input must follow the guide. To be accepted, the input line must contain all entries up to the NOTE field, which can be blank if desired. Any detected error will cause the line to be rejected. The word REJECTED will appear on the input line for a short period of time, then the cursor will return, indicating reentry is ready.

The ADD mode is terminated at any time by entering a completely empty ADD line. To do this, hit ENTER with only the cursor showing.

MODIFY Mode

In this mode, records are recalled for inspection and any necessary corrective action. The prompting is as shown in Table 4.

In the Table 4 prompting, the user has called for record 55. The record content is displayed and the program pauses for a new entry. If no change is to be made, hit ENTER. If a change is to be made, the entire record must be reentered. As with the ADD mode, the input is position-oriented. Use the original entry as a guide.

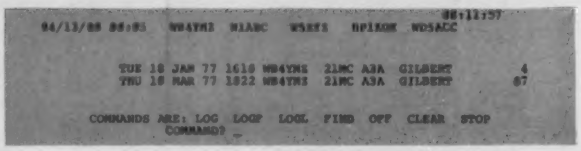
To exit this mode, merely specify RECORD NR 0.

COMMAND Mode

This mode is used to enter contacts into the log during station operation. It is called when the proper emission mode code is entered in response to the first prompted entry. The user must first identify the operating band and is prompted to do so as shown in Table 5(a). On entry, the COMMAND line prompting appears as shown in Table 5(b). Use of each command is explained below.

1) LOG—The command word LOG must always be followed by a station call. An acceptable command line would appear: COMMAND LOG WB9XXX. As the LOG command is executed, the program takes a snapshot of the clock, retaining the hour and minutes. The DATE, TIME, and CALL appear at the top of the screen and the command line will reappear at the lower command line position. The program is paused awaiting the next command.

The LOG line is *not* posted to the log at this time. Since round-table QSOs are quite frequent, the system is programmed to allow entry of up to five callsigns for the same QSO. If an unposted LOG line appears at the top of the screen, any subsequent LOG XXXXXX will add the callsign to the log list. An attempt to enter more than five such callsigns will cause the program to inform the user the table is full. The command will be discarded.



```
                                                              08:11:57
04/13/80 08:05   WB4YMZ  W1ABC   W5XYZ   DP1XXX  WD5ACC

             TUE 18 JAN 77 1618 WB4YMZ  21MC A3A  GILBERT          4
             THU 18 MAR 77 1822 WB4YMZ  21MC A3A  GILBERT         87

         COMMANDS ARE: LOG  LOGF  LOGL  FIND  OFF  CLEAR  STOP
                COMMAND? _
```

Fig. 1. A sample QSO with five other stations. FIND command was used to display previous contacts with WB4YMZ.

2) LOGF—This is an extension of the LOG command and operates exactly as does LOG except that it initiates a search. Given the command LOGF WB9XXX, the program will display the top log line. The file will be opened and searched for the first (earliest) logged entry for WB9XXX. If a prior entry is found, the record will be displayed below the log line. If there has been no previous contact, only the station call will be displayed. Five such lines can be displayed, one for each of the permitted round-table entries.

3) LOGL—This, too, is an extension of the LOG command. It differs from LOGF only in the fact that it will display the last (latest) log entry for the specified station.

4) FIND—This command requires a station call, as in FIND WB9XXX. It is used to initiate a search for a specified station without entering the call into the log line. The search will display both the earliest and latest entries for the station. If there has been no prior entry, only the station call will appear. Two lines are reserved immediately above the command prompting lines for this display.

5) OFF—This single word command signals to the program that the QSO has terminated and that the log lines are to be posted to the file. The user is prompted for entry of the NOTE or NAME line for each of the station calls appearing in the log line. The records are posted in the order entered and at the time the NAME prompting is answered. The NAME entry is actually the 10-digit scratch. Any ten characters can be sent to the file.

6) CLEAR—This single word command will initialize the log line without leaving the command mode. If there are any station calls appearing in the log line, this command will remove them without posting to the log.

7) STOP—The STOP command is as it implies. The result is the same as hitting the break key.

Fig. 1 illustrates a fictitious session in which six stations are in a round-table QSO. The top line is the clock, followed by the log line with five station entries. Two lines resulting from a search for previous WB4YMZ contacts are grouped under the log line. The number appearing at the extreme right of the record line is the record number for that log entry. The two record lines resulted from a FIND command.

If the situation were actually as pictured, an OFF command would post five lines in the log. These would be identical except for the station callsign and the name of the station operator. ■

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Lewis A. Thompson W5IFQ
Applied Research Laboratories
The University of Texas at Austin
Austin TX 78712

RTTY with the H8

—a Heath-based RTTY system

The 8-bit microcomputer is ideally suited to controlling a radioteletype (RTTY) amateur station. Normally manual functions such as character shift (LTRS or FIGS) and end-of-line detection can be done automatically by the computer. Complex functions such as text storage, automatic CQ, and Morse code identification can easily be implemented in the computer's software.

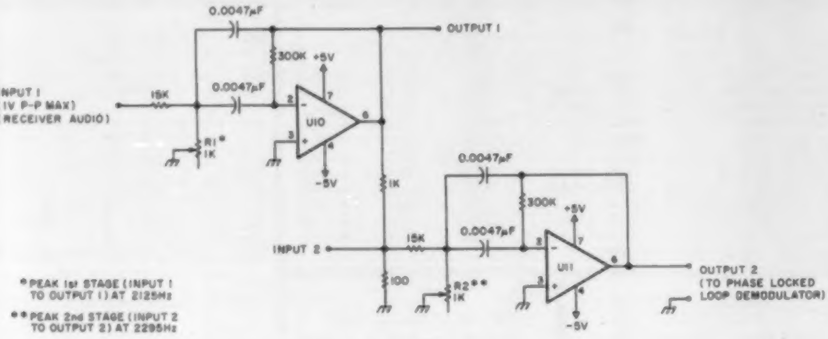

0.0047μF
OUTPUT 1
300K
+5V
INPUT 1
(1V P-P MAX)
(RECEIVER AUDIO)
15K
0.0047μF
U10
R1*
1K
-5V
1K
0.0047μF
300K
+5V
INPUT 2
15K
0.0047μF
U11
OUTPUT 2
(TO PHASE LOCKED
LOOP DEMODULATOR)
100
R2**
1K
-5V
*PEAK 1st STAGE (INPUT 1 TO OUTPUT 1) AT 2125Hz
**PEAK 2nd STAGE (INPUT 2 TO OUTPUT 2) AT 2295Hz

Fig. 1. RTTY input filter.

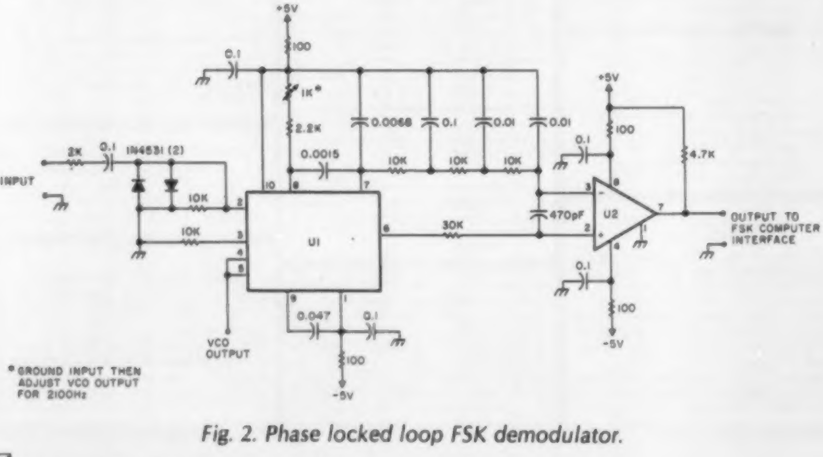

+5V
100
0.1
1K*
2.2K
0.0068
0.1
0.01
0.01
+5V
100
4.7K
INPUT
2K
0.1
1N4531 (2)
0.0015
10K
10K
10K
0.1
10K
10K
U1
30K
470pF
U2
OUTPUT TO
FSK COMPUTER
INTERFACE
0.1
100
0.047
0.1
VCO
OUTPUT
100
-5V
-5V
*GROUND INPUT THEN ADJUST VCO OUTPUT FOR 2100Hz

Fig. 2. Phase locked loop FSK demodulator.

Amateur RTTY Conventions

Amateur RTTY in the high frequency (HF) radio spectrum (1 through 30 MHz) uses frequency-shift keying (FSK) to transmit Baudot characters. Each Baudot character consists of a start bit, five data bits, and 1½ stop bits. Baudot code consists of two subsets of characters, LTRS and FIGS. LTRS consists of all the uppercase alphabetic characters and FIGS consists of the numbers and miscellaneous punctuation characters. The high state or "mark" is by convention the higher frequency of the two FSK signals. A frequency shift of 170 Hz has replaced the old standard of 850 Hz. Rates of both 60 and 100 words per minute are now in use but 60 wpm is still dominant.[1] A popular means to generate FSK is to

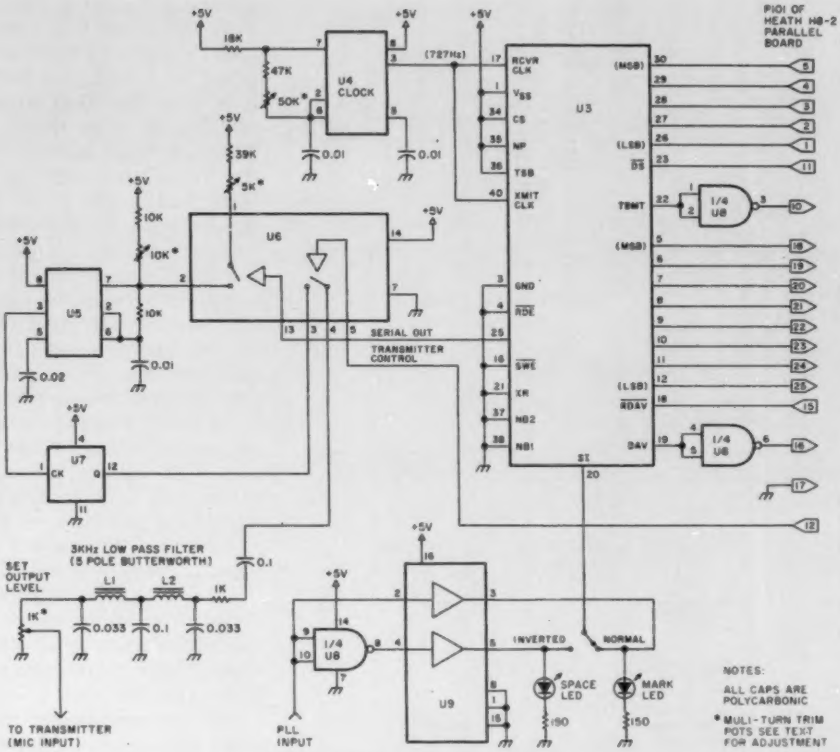


Fig. 3. FSK computer interface.

feed audio FSK into the microphone input of a single-sideband (SSB) suppressed carrier radio transmitter.

System Description

The RTTY system described in this article consists of the following equipment: 1) Heath H8 computer, 16K memory, serial (H8-5) and parallel (H8-2) interface boards; 2) Heath H9 video terminal; 3) dual GE 5121 cassette tape decks; 4) Heath SB-300 single-sideband receiver; 5) Heath SB-401 single-sideband transmitter, and 6) author-constructed RTTY interface.

No hardware modifications were done on any of these equipments. This minimal system will receive and transmit RTTY on all authorized HF bands. A tuning aid and inverted code switch are included to improve reception. All transmit and receive functions are controlled from the H9 terminal as follows:

CTRL-A—Transmit Morse code identification
CTRL-B—Go to transmit mode (turn on transmitter)
CTRL-C—Transmit buffer (CQ or message)
CTRL-D—Force LTRS code during receive mode
ESC KEY—Go to receive mode (turn off transmitter)

Shift characters are automatically transmitted when called for by Baudot convention. After 72 characters, line feed, two carriage returns, and the LTRS code are automatically transmitted. A 28-character type-ahead buffer is included in the transmit program to prevent loss of text.

RTTY Input Filter

The bandwidth of the SB-300 receiver is 2.1 kHz (350 through 2450 Hz). Approximately 300 Hz of bandwidth is required to receive 60 wpm, 170-Hz shift RTTY.[2] The phase locked loop demodulator used in the RTTY interface unit will attempt to lock onto any signal within 400 Hz of its nominal vco frequency. Without a narrow bandwidth filter, near-frequency signals will cause significant receiving errors. The easiest place to add a receiver filter is between the audio output of the receiver and the RTTY interface. The filter of Fig. 1 has a bandwidth of 300 Hz centered at 2210 Hz and a voltage gain of 10. Each stage should be adjusted separately using an accurate signal generator and an output indicator. In operation, input 1 is connected to the receiver audio output and output 2 is connected to phase locked loop demodulator input.

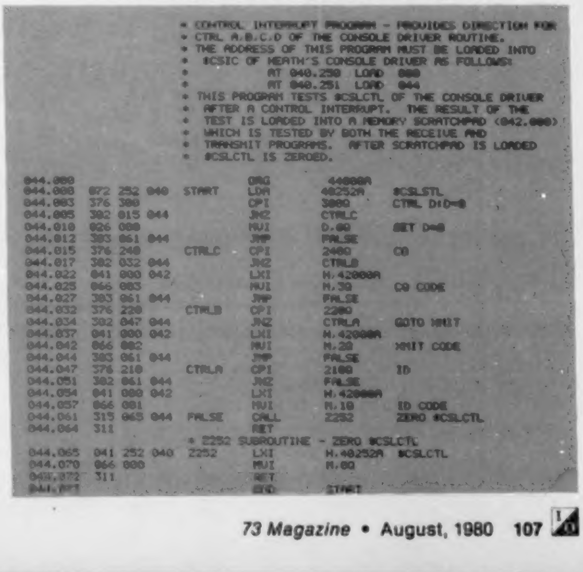
Phase Locked Loop FSK Demodulator

The demodulator shown in Fig. 2 converts audio frequency shifts into serial binary data. Within device U1, a phase detector sends a voltage to a vco, forcing it to the same frequency (phase) as the input signal. This forcing voltage is the actual output of the phase locked loop. The potentiometer shown in Fig. 2 is used to adjust the zero-input vco frequency to a value of 2100 Hz. A frequency counter should be used for this adjustment. The device U2 converts the phase locked loop output to TTL voltage levels.

FSK Computer Interface

The serial word from the demodulator is converted to a valid parallel word and sent to the computer by the FSK computer interface shown in Fig. 3. The UART (U3) is hardware-pro-

Control interrupt program listing.



```
                                * CONTROL INTERRUPT PROGRAM - PROVIDES DIRECTION FOR
                                * CTRL A,B,C,D OF THE CONSOLE DRIVER ROUTINE.
                                * THE ADDRESS OF THIS PROGRAM MUST BE LOADED INTO
                                *  $CSIC OF HEATH'S CONSOLE DRIVER AS FOLLOWS:
                                *          AT 040.250  LOAD  000
                                *          AT 040.251  LOAD  044
                                * THIS PROGRAM TESTS $CSLCTL OF THE CONSOLE DRIVER
                                *  AFTER A CONTROL INTERRUPT.  THE RESULT OF THE
                                *  TEST IS LOADED INTO A MEMORY SCRATCHPAD (042.000)
                                *  WHICH IS TESTED BY BOTH THE RECEIVE AND
                                *  TRANSMIT PROGRAMS.  AFTER SCRATCHPAD IS LOADED
                                *  $CSLCTL IS ZEROED.

044.000                                 ORG      44000A
044.000  072 252 040   START    LDA      40252A    $CSLSTL
044.003  376 300                CPI      300Q      CTRL D(D=0
044.005  302 015 044            JNZ      CTRLC
044.010  026 000                MVI      D,00      SET D=0
044.012  303 061 044            JMP      FALSE
044.015  376 240       CTRLC    CPI      240Q      CQ
044.017  302 032 044            JNZ      CTRLB
044.022  041 000 042            LXI      H,42000A
044.025  066 003                MVI      M,3Q      CQ CODE
044.027  303 061 044            JMP      FALSE
044.032  376 220       CTRLB    CPI      220Q
044.034  302 047 044            JNZ      CTRLA     GOTO XMIT
044.037  041 000 042            LXI      H,42000A
044.042  066 002                MVI      M,2Q      XMIT CODE
044.044  303 061 044            JMP      FALSE
044.047  376 210       CTRLA    CPI      210Q      ID
044.051  302 061 044            JNZ      FALSE
044.054  041 000 042            LXI      H,42000A
044.057  066 001                MVI      M,1Q      ID CODE
044.061  315 065 044   FALSE    CALL     Z252      ZERO $CSLCTL
044.064  311                    RET
                       * Z252 SUBROUTINE - ZERO $CSLCTL
044.065  041 252 040   Z252     LXI      H,40252A  $CSLCTL
044.070  066 000                MVI      M,0Q
044.072  311                    RET
044.073                         END      START
```

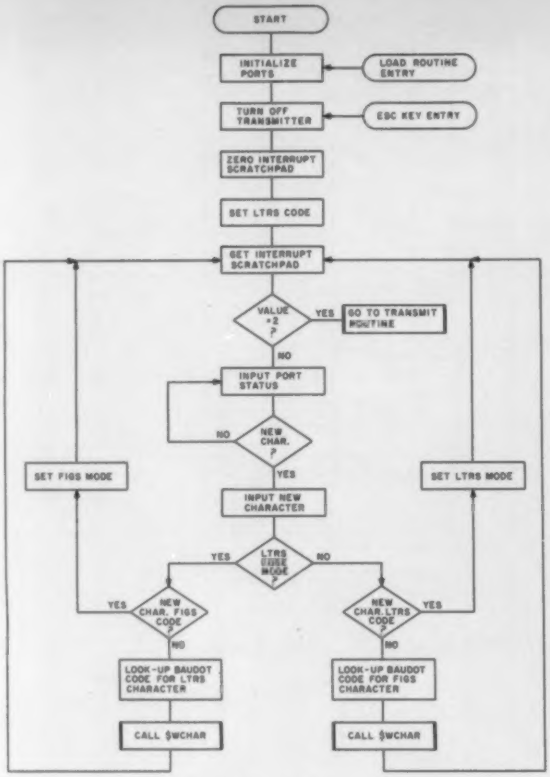

START
INITIALIZE PORTS
LOAD ROUTINE ENTRY
TURN OFF TRANSMITTER
ESC KEY ENTRY
ZERO INTERRUPT SCRATCHPAD
SET LTRS CODE
GET INTERRUPT SCRATCHPAD
VALUE =2 ?
YES
GO TO TRANSMIT ROUTINE
NO
INPUT PORT STATUS
NO
NEW CHAR. ?
YES
SET FIGS MODE
SET LTRS MODE
INPUT NEW CHARACTER
YES
LTRS MODE ?
NO
YES
NEW CHAR. FIGS CODE ?
NO
NEW CHAR. LTRS CODE ?
YES
NO
LOOK-UP BAUDOT CODE FOR LTRS CHARACTER
LOOK-UP BAUDOT CODE FOR FIGS CHARACTER
CALL $WCHAR
CALL $WCHAR

Fig. 4. RTTY receiver flowchart.

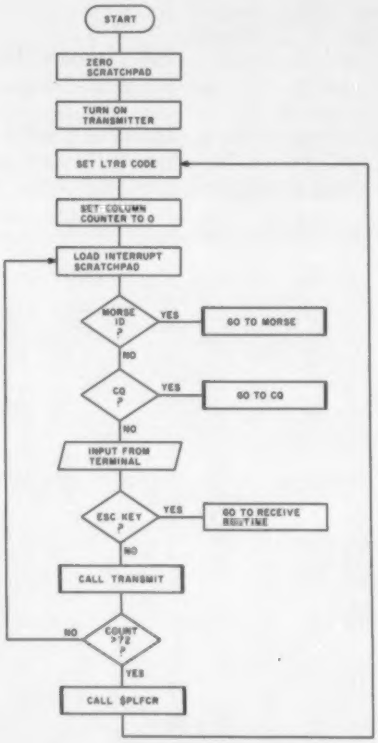

START
ZERO SCRATCHPAD
TURN ON TRANSMITTER
SET LTRS CODE
SET COLUMN COUNTER TO 0
LOAD INTERRUPT SCRATCHPAD
MORSE ID ?
YES
GO TO MORSE
NO
CQ ?
YES
GO TO CQ
NO
INPUT FROM TERMINAL
ESC KEY ?
YES
GO TO RECEIVE ROUTINE
NO
CALL TRANSMIT
NO
COUNT >72 ?
YES
CALL $PLFCR

Fig. 5. RTTY transmit routine.

grammed for 5-bit words and 1½ stop bits. The UART's clock, U4, is adjusted for a frequency that is 16 times the RTTY baud rate. For 60 wpm, the frequency of the clock is 727 Hz. When the UART detects and loads a valid Baudot word, it signals the computer on the DAV (data available) line. After the computer accepts the parallel word, it signals back on the RDAV (reset data available) line, allowing the UART to load another word in its buffer. The PLL input circuits, including U9 and part of U8, allow receiving of normal and inverted signals and provide a needed tuning aid. When a RTTY signal is correctly received, the mark LED should light during idle moments between characters and both should light during continuous transmission.

In the transmit mode, the UART signals the computer to load a word using the TBMT (transmitter buffer empty) line. After the computer has loaded a Baudot word, it signals the UART to begin serial transmission using the DS (data strobe) line. The UART adds the correct number of start (1) and stop (1½) bits and then transmits the word serially at a baud rate of one-sixteenth its transmit clock rate. The serial transmit signal operates an electronic switch in U6 that keys a two-frequency oscillator (U5). When the serial out line is low, the switch is open and U5 should be adjusted by the 10k-Ω potentiometer to oscillate at 4250 Hz. When the serial line is high, the switch is closed and U5 should be adjusted by the 5k-Ω potentiometer to oscillate at 4590 Hz.

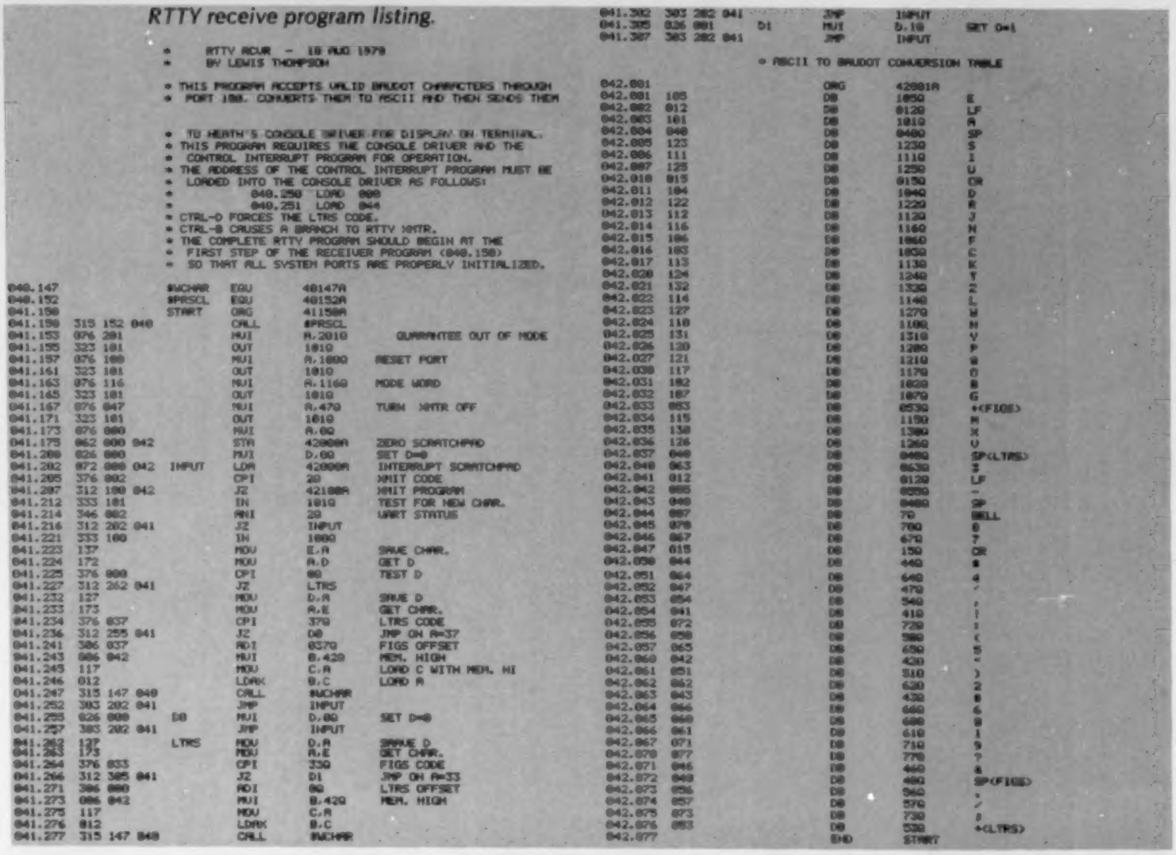
The J-K flip-flop device, U7, divides the output frequency of U5 by two to provide a symmetrical square wave at the correct mark and space frequencies. The output of U7 goes through an electronic switch to a low-pass filter and then to the microphone input of the SSB radio transmitter. The second electronic switch is controlled by the "reader on/off" line from the H8-2 parallel interface board. This arrangement allows the computer to turn the transmitter on and off using the transmitter's voice-operated switch (VOX) and also to transmit a Morse code identification signal. The 3-kHz low-pass filter converts the square wave output of U7 to a sine wave. The 1k-Ω potentiometer should be adjusted to provide the same output level as the microphone normally used with the transmitter. The complete filter and level adjust potentiometer should be well shielded to prevent stray noise from being transmitted.

H8-2 Parallel Interface Board

The FSK computer interface is connected to one of three parallel ports of Heath's H8-2 parallel interface board. The port address jumpers for the selected parallel port should be connected for 100_8. On that port, connect the logic jumpers as follows: 1) A_1-A_2, open; 2) B_1-B_2, open; 3) C_1-C_2, shorted, and 4) E_1-E_2, shorted. The output of the FSK computer interface (Fig. 3) is connected to the parallel port at P101 by a ribbon cable terminated with the Heath-supplied 25-pin connector.

SSB Receiver and Transmitter Operation

Both the SSB receiver and transmitter must be operated in the upper sideband (USB) mode for correct polarity reception and transmission. The receiver should have less than 100 Hz/H drift after warm-up. Most SSB transmitters are not designed to operate at the 100% duty cycle required of RTTY. The manufacturer's specifications



RTTY receive program listing.

```
                       *      RTTY RCVR  -  18 AUG 1979
                       *      BY LEWIS THOMPSON

                       * THIS PROGRAM ACCEPTS VALID BAUDOT CHARACTERS THROUGH
                       *  PORT 100. CONVERTS THEM TO ASCII AND THEN SENDS THEM

                       *  TO HEATH'S CONSOLE DRIVER FOR DISPLAY ON TERMINAL.
                       * THIS PROGRAM REQUIRES THE CONSOLE DRIVER AND THE
                       *  CONTROL INTERRUPT PROGRAM FOR OPERATION.
                       * THE ADDRESS OF THE CONTROL INTERRUPT PROGRAM MUST BE
                       *  LOADED INTO THE CONSOLE DRIVER AS FOLLOWS:
                       *           040.250  LOAD  000
                       *           040.251  LOAD  044
                       * CTRL-D FORCES THE LTRS CODE.
                       * CTRL-B CAUSES A BRANCH TO RTTY XMTR.
                       * THE COMPLETE RTTY PROGRAM SHOULD BEGIN AT THE
                       *  FIRST STEP OF THE RECEIVER PROGRAM (040.150)
                       *  SO THAT ALL SYSTEM PORTS ARE PROPERLY INITIALIZED.

040.147                $WCHAR   EQU     40147A
040.152                $PRSCL   EQU     40152A
041.150                START    ORG     41150A
041.150  315 152 040            CALL    $PRSCL
041.153  076 201                MVI     A,201Q       GUARANTEE OUT OF MODE
041.155  323 101                OUT     101Q
041.157  076 100                MVI     A,100Q     RESET PORT
041.161  323 101                OUT     101Q
041.163  076 116                MVI     A,116Q     MODE WORD
041.165  323 101                OUT     101Q
041.167  076 047                MVI     A,47Q      TURN  XMTR OFF
041.171  323 101                OUT     101Q
041.173  076 000                MVI     A,0Q
041.175  062 000 042            STA     42000A     ZERO SCRATCHPAD
041.200  026 000                MVI     D,0Q       SET D=0
041.202  072 000 042   INPUT    LDA     42000A     INTERRUPT SCRATCHPAD
041.205  376 002                CPI     2Q         XMIT CODE
041.207  312 100 042            JZ      42100A     XMIT PROGRAM
041.212  333 101                IN      101Q       TEST FOR NEW CHAR.
041.214  346 002                ANI     2Q         UART STATUS
041.216  312 202 041            JZ      INPUT
041.221  333 100                IN      100Q
041.223  137                    MOV     E,A        SAVE CHAR.
041.224  172                    MOV     A,D        GET D
041.225  376 000                CPI     0Q         TEST D
041.227  312 262 041            JZ      LTRS
041.232  127                    MOV     D,A        SAVE D
041.233  173                    MOV     A,E        GET CHAR.
041.234  376 037                CPI     37Q        LTRS CODE
041.236  312 255 041            JZ      D0         JMP ON A=37
041.241  306 037                ADI     037Q       FIGS OFFSET
041.243  006 042                MVI     B,42Q      MEM. HIGH
041.245  117                    MOV     C,A        LOAD C WITH MEM. HI
041.246  012                    LDAX    B,C        LOAD A
041.247  315 147 040            CALL    $WCHAR
041.252  303 202 041            JMP     INPUT
041.255  026 000       D0       MVI     D,0Q       SET D=0
041.257  303 202 041            JMP     INPUT
041.262  127           LTRS     MOV     D,A        SAVE D
041.263  173                    MOV     A,E        GET CHAR.
041.264  376 033                CPI     33Q        FIGS CODE
041.266  312 305 041            JZ      D1         JMP ON A=33
041.271  306 000                ADI     0Q         LTRS OFFSET
041.273  006 042                MVI     B,42Q      MEM. HIGH
041.275  117                    MOV     C,A
041.276  012                    LDAX    B,C
041.277  315 147 040            CALL    $WCHAR
041.302  303 202 041            JMP     INPUT
041.305  026 001       D1       MVI     D,1Q       SET D=1
041.307  303 202 041            JMP     INPUT

                       * ASCII TO BAUDOT CONVERSION TABLE

042.001                         ORG     42001A
042.001  105                    DB      105Q       E
042.002  012                    DB      012Q       LF
042.003  101                    DB      101Q       A
042.004  040                    DB      040Q       SP
042.005  123                    DB      123Q       S
042.006  111                    DB      111Q       I
042.007  125                    DB      125Q       U
042.010  015                    DB      015Q       CR
042.011  104                    DB      104Q       D
042.012  122                    DB      122Q       R
042.013  112                    DB      112Q       J
042.014  116                    DB      116Q       N
042.015  106                    DB      106Q       F
042.016  103                    DB      103Q       C
042.017  113                    DB      113Q       K
042.020  124                    DB      124Q       T
042.021  132                    DB      132Q       Z
042.022  114                    DB      114Q       L
042.023  127                    DB      127Q       W
042.024  110                    DB      110Q       H
042.025  131                    DB      131Q       Y
042.026  120                    DB      120Q       P
042.027  121                    DB      121Q       Q
042.030  117                    DB      117Q       O
042.031  102                    DB      102Q       B
042.032  107                    DB      107Q       G
042.033  053                    DB      053Q       +(FIGS)
042.034  115                    DB      115Q       M
042.035  130                    DB      130Q       X
042.036  126                    DB      126Q       V
042.037  040                    DB      040Q       SP(LTRS)
042.040  063                    DB      063Q       3
042.041  012                    DB      012Q       LF
042.042  055                    DB      055Q       -
042.043  040                    DB      040Q       SP
042.044  007                    DB      7Q         BELL
042.045  070                    DB      70Q        8
042.046  067                    DB      67Q        7
042.047  015                    DB      15Q        CR
042.050  044                    DB      44Q        $
042.051  064                    DB      64Q        4
042.052  047                    DB      47Q        '
042.053  054                    DB      54Q        ,
042.054  041                    DB      41Q        !
042.055  072                    DB      72Q        :
042.056  050                    DB      50Q        (
042.057  065                    DB      65Q        5
042.060  042                    DB      42Q        "
042.061  051                    DB      51Q        )
042.062  062                    DB      62Q        2
042.063  043                    DB      43Q        #
042.064  066                    DB      66Q        6
042.065  060                    DB      60Q        0
042.066  061                    DB      61Q        1
042.067  071                    DB      71Q        9
042.070  077                    DB      77Q        ?
042.071  046                    DB      46Q        &
042.072  040                    DB      40Q        SP(FIGS)
042.073  056                    DB      56Q        .
042.074  057                    DB      57Q        /
042.075  073                    DB      73Q        ;
042.076  053                    DB      53Q        +(LTRS)
042.077                         END     START
```

should be consulted to determine a safe maximum power limit. The SB-401 transmitter is presently being operated at a plate current of 150 mA rather than the SSB-recommended 250 mA.

RTTY Interface Software

The speed requirements as well as the lack of complex mathematical expressions allowed the interface software to be written in assembly language. The software is divided into three separately assembled programs, plus Heath's console driver program. Listings of the three RTTY programs are included in this article.

RTTY Receiver Program

The receiver program uses the console driver and the CIP programs. An excellent description of Heath's console driver is contained in issue No. 2 of *Remark*.[3] The RTTY software entry point should be the start of the receive program (041.150 offset octal) to effect port initialization. Fig. 4 shows a flowchart for the receive program. Both the console terminal's serial port and the RTTY interface's parallel port are initialized at the beginning of the program. The command word, 047_8, sent to the control port (101_8) turns the transmitter off. The CIP program places different numbers in a scratchpad (042/000) based upon which CTRL key interrupts occur. The receive program initially zeros this location and then tests it for a branch to the transmit routine each time a new character loop is performed. After testing for a transmit program branch, the first bit of the control input port is tested to determine if a new character has been loaded in the RTTY interface UART. If a new character is present, it is loaded into the computer, thereby freeing the interface UART to search for the next character. After loading a character, the routine checks whether it is in the LTRS (D=1) mode. If it is in the LTRS mode, the new character is compared with the FIGS code. If the new character is the FIGS code, the FIGS mode is set (D=0) and the program loops back for a new character. If the new character is not the FIGS code, its numeric value forms the lower 8-bit address at which the Baudot character's equivalent ASCII value is stored. This value is sent to the terminal via the console driver routine $WCHAR for display. The same logic is followed for the FIGS code branch. The FIGS character's numeric value is added to an offset (37_8) to form the lower 8-bit address for entry into the conversion table. When a CTRL-D is keyed, the CIP program sets D=0, forcing the receive program into the LTRS mode.

RTTY Transmit Program

The transmit program consists of three separate routines: transmit, CQ, and Morse ID. The transmit routine together with the CIP and console driver programs generate Baudot code from the terminal. A flowchart for the transmit routine is shown in Fig. 5. The program begins by zeroing the scratchpad and then turning on the transmitter. Both the LTRS/FIGS register (D) and the column count register (E) are zeroed before the scratchpad is tested. The scratchpad is tested for either a branch to the Morse ID routine or the CQ routine. If both tests are

RTTY transmit program listing.

```
                        * RTTY XMTR
                        * BY LEWIS A. THOMPSON
                        * 3006 CARLISLE
                        * AUSTIN, TEXAS
                        * JAN. 6, 1979

                        * THIS PROGRAM GENERATES BAUDOT CHARACTERS FOR
                        *  TRANSMISSION THRU AN EXTERNAL UART AY-3-1015.
                        * PARALLEL PORT 100/101 IS USED BY THIS PROGRAM.
                        * THE BAUDOT CHARACTERS LTRS AND FIGS ARE
                        *  GENERATED BY PROGRAM WHEN NEEDED.
                        * AFTER 72 SPACES, LINE FEED-TWO CARRIAGE RETURNS-
                        *  AND LTRS CODE ARE GENERATED.
                        * THE CONSOLE DRIVER'S 20 CHARACTER TYPE-AHEAD
                        *  BUFFER IS USED.
                        * ALL PRINTABLE CHARACTERS ARE ECHOED TO TERMINAL
                        *  USING DRIVER ROUTINE.
                        * ESC KEY CAUSES A BRANCH TO THE RECEIVER ROUTINE.

040.144                 $RCHAR   EQU      40144A
040.152                 $PRSCL   EQU      40152A
040.147                 $WCHAR   EQU      40147A
041.167                 RCVR     EQU      41167A
041.153                 RCVR1    EQU      41153A
042.100                          ORG      42100A
042.100   076 000       START    MVI      A,0Q      SET A=0
042.102   062 000 042            STA      42000A    ZERO SCRATCHPAD
042.105   076 007                MVI      A,7Q      XMIT MODE WORD
042.107   323 101                OUT      101Q      TURN ON XMTR
042.111   026 000       NXLINE   MVI      D,0Q      SET LTRS CODE
042.113   036 000                MVI      E,0Q      SET COLUMN COUNT=0
042.115   072 000 042   SMLINE   LDA      42000A    INTERRUPT SCRATCHPAD
042.120   376 001                CPI      1Q        MORSE ID CODE
042.122   312 200 043            JZ       MORSE     GOTO ID ROUTINE
042.125   376 003                CPI      3Q        CQ CODE
042.127   312 100 044            JZ       CQ        CQ ROUTINE
042.132   315 144 040            CALL     $RCHAR    GET CHARACTER
042.135   376 033                CPI      33Q       ESC KEY CODE
042.137   312 167 041            JZ       RCVR      GOTO RCVR
042.142   315 161 042            CALL     XMIT
042.145   173                    MOV      A,E       RECOVER E
042.146   376 110                CPI      110Q      COMPLETED LINE (72)
042.150   302 115 042            JNZ      SMLINE
042.153   315 304 042            CALL     $PLFCR    XMIT LF,CR,CR,LTRS
042.156   303 111 042            JMP      NXLINE
                        * XMIT SUBROUTINE - THIS ROUTINE CONVERTS ASCII
                        *  CHARACTERS FROM TERMINAL TO BAUDOT THEN SENDS
                        *  THEM TO THE EXTERNAL UART VIA PORT 100.
042.161   345           XMIT     PUSH     H         SAVE H
042.162   315 147 040            CALL     $WCHAR    ECHO CHAR. TO TERM.
042.165   376 015                CPI      15Q       CR - ASCII
042.167   302 203 042            JNZ      $LF
042.172   076 010                MVI      A,10Q     CR - BAUDOT
042.174   315 343 042            CALL     $SEND     XMIT CR
042.177   036 000                MVI      E,0Q      SET COLUMN COUNT=0
042.201   341                    POP      H         RESTORE H
042.202   311                    RET
042.203   376 012       $LF      CPI      12Q       LF - ASCII
042.205   302 217 042            JNZ      $SP
042.210   076 002                MVI      A,2Q      LF - BAUDOT
042.212   315 343 042            CALL     $SEND     XMIT LF
042.215   341                    POP      H
042.216   311                    RET
042.217   376 040       $SP      CPI      40Q       SPACE - ASCII
042.221   302 234 042            JNZ      TEST
042.224   076 004                MVI      A,4Q      SPACE - BAUDOT
042.226   315 343 042            CALL     $SEND     XMIT SPACE
042.231   303 301 042            JMP      $INRE
                        * TEST FOR LETTERS OR FIGURES CODE
042.234   147           TEST     MOV      H,A       SAVE ASCII CHAR.
042.235   172                    MOV      A,D       GET D
042.236   376 000                CPI      0Q        TEST D
042.240   312 257 042            JZ       LTRS
042.243   174                    MOV      A,H       GET ASCII CHAR.
042.244   376 100                CPI      100Q
042.246   372 270 042            JM       $OUT
042.251   315 367 042            CALL     $PLTRS
042.254   303 270 042            JMP      $OUT
042.257   174           LTRS     MOV      A,H       GET ASCII CHAR.
042.260   376 100                CPI      100Q
042.262   362 270 042            JP       $OUT
042.265   315 355 042            CALL     $PFIGS
                        * LOOK-UP BAUDOT CHARACTER FROM TABLE
042.270   306 037       $OUT     ADI      37Q       BAUDOT TABLE OFFSET
042.272   117                    MOV      C,A       MEM. ADD. LOW
042.273   006 043                MVI      B,43Q     MEM. ADD. HIGH
042.275   012                    LDAX     B,C
042.276   315 343 042            CALL     $SEND     XMIT BAUDOT CHAR.
042.301   034           $INRE    INR      E         E=E+1
042.302   341                    POP      H
042.303   311                    RET

                        * $PLFCR SUBROUTINE - PRINTS LF+TWO CR'S+LTRS
042.304   076 002       $PLFCR   MVI      A,2Q      LF - BAUDOT
042.306   315 343 042            CALL     $SEND
042.311   076 012                MVI      A,12Q     LF - ASCII
042.313   315 147 040            CALL     $WCHAR
042.316   076 015                MVI      A,15Q     CR - ASCII
042.320   315 147 040            CALL     $WCHAR
042.323   076 010                MVI      A,10Q     CR - BAUDOT
042.325   315 343 042            CALL     $SEND
042.330   076 010                MVI      A,10Q
042.332   315 343 042            CALL     $SEND
042.335   076 037                MVI      A,37Q     LTRS CODE
042.337   315 343 042            CALL     $SEND
042.342   311                    RET
                        * $SEND SUBROUTINE - SENDS CHARACTER TO OUTPUT
                        *  THEN WAITS FOR HANDSHAKE FROM UART.
042.343   323 100       $SEND    OUT      100Q      SEND CHARACTER TO PORT
042.345   333 101       LOOP1    IN       101Q
042.347   346 001                ANI      1Q        MASK
042.351   312 345 042            JZ       LOOP1
042.354   311                    RET
                        * $PFIGS SUBROUTINE - SEND BAUDOT FIGS CODE
042.355   365           $PFIGS   PUSH     PSW       SAVE A
042.356   076 033                MVI      A,33Q     FIGS CODE
042.360   026 001                MVI      D,1Q      SET D=1
042.362   315 343 042            CALL     $SEND
042.365   361                    POP      PSW
042.366   311                    RET
                        * $PLTRS SUBROUTINE - SENDS BAUDOT LTRS CODE.
042.367   365           $PLTRS   PUSH     PSW       SAVE A
042.370   076 037                MVI      A,37Q     LETTERS CODE
042.372   026 000                MVI      D,0Q      SET D=0
042.374   315 343 042            CALL     $SEND
042.377   361                    POP      PSW
043.000   311                    RET
                        * XMTR TABLE
043.100                          ORG      43100A
043.100   015                    DB       15Q       !
043.101   021                    DB       21Q       "
043.102   024                    DB       24Q       #
043.103   011                    DB       11Q       $
043.104   004                    DB       4Q
043.105   032                    DB       32Q       &
043.106   013                    DB       13Q       '
043.107   017                    DB       17Q       (
043.110   022                    DB       22Q       )
043.111   004                    DB       4Q
043.112   004                    DB       4Q
043.113   014                    DB       14Q       ,
043.114   003                    DB       3Q        -
043.115   034                    DB       34Q       .
043.116   035                    DB       35Q       /
043.117   026                    DB       26Q       0
043.120   027                    DB       27Q       1
043.121   023                    DB       23Q       2
043.122   001                    DB       1Q        3
```

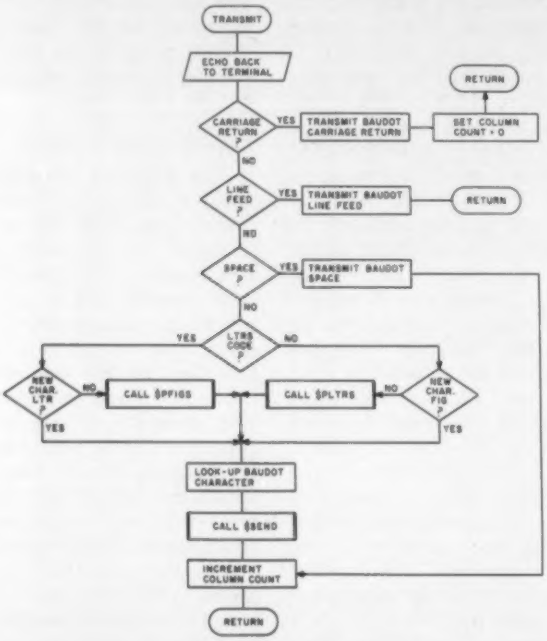
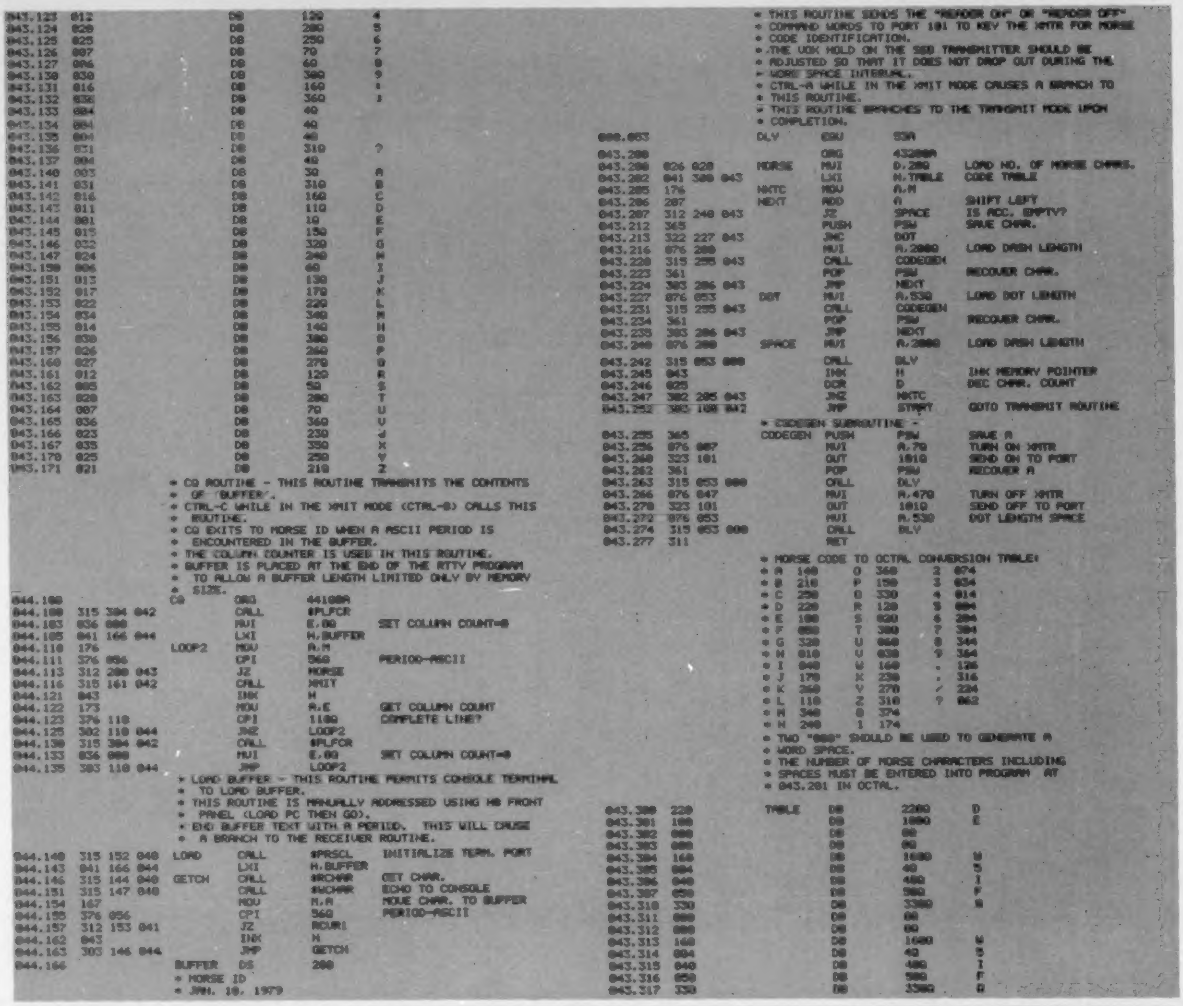


Fig. 6. Transmit subroutine.

invalid, the program gets the next character from the terminal using a console driver routine called $RCHAR. If the ASCII character is not the ESC key code, then the program calls the subroutine XMIT; otherwise, it branches to the receiver program. A flowchart of the XMIT subroutine is shown in Fig. 6. After being called, this subroutine immediately echoes the character back to the terminal for display using the console driver subroutine $WCHAR. XMIT then compares the ASCII character with the character for carriage return (CR), line feed (LF), or space. If any of these tests is valid, the valid character is converted to Baudot and transmitted. The CR test sets the column count to zero and returns to the main program for another character. The LF test simply returns to the main program for another character. The space test branches within the subroutine to a point where the column count is incremented, and a return to the main program is executed.

If all three tests are invalid, XMIT then tests the LTRS/FIGS register. If the program is in the LTRS mode, the new character is compared to 100_8. A positive result means the new character is an ASCII LTR and its Baudot equivalent is transmitted. If the comparison is negative, the new character is a FIG, and the Baudot FIGS shift character (33_8) must be transmitted before the character. After the Baudot character is transmitted,



```
043.123  012                  DB      12Q      4
043.124  020                  DB      20Q      5
043.125  025                  DB      25Q      6
043.126  007                  DB      7Q       7
043.127  006                  DB      6Q       8
043.130  030                  DB      30Q      9
043.131  016                  DB      16Q      :
043.132  036                  DB      36Q      ;
043.133  004                  DB      4Q
043.134  004                  DB      4Q
043.135  004                  DB      4Q
043.136  031                  DB      31Q      ?
043.137  004                  DB      4Q
043.140  003                  DB      3Q       A
043.141  031                  DB      31Q      B
043.142  016                  DB      16Q      C
043.143  011                  DB      11Q      D
043.144  001                  DB      1Q       E
043.145  015                  DB      15Q      F
043.146  032                  DB      32Q      G
043.147  024                  DB      24Q      H
043.150  006                  DB      6Q       I
043.151  013                  DB      13Q      J
043.152  017                  DB      17Q      K
043.153  022                  DB      22Q      L
043.154  034                  DB      34Q      M
043.155  014                  DB      14Q      N
043.156  030                  DB      30Q      O
043.157  026                  DB      26Q      P
043.160  027                  DB      27Q      Q
043.161  012                  DB      12Q      R
043.162  005                  DB      5Q       S
043.163  020                  DB      20Q      T
043.164  007                  DB      7Q       U
043.165  036                  DB      36Q      V
043.166  023                  DB      23Q      W
043.167  035                  DB      35Q      X
043.170  025                  DB      25Q      Y
043.171  021                  DB      21Q      Z
                * CQ ROUTINE - THIS ROUTINE TRANSMITS THE CONTENTS
                *  OF 'BUFFER'.
                * CTRL-C WHILE IN THE XMIT MODE (CTRL-B) CALLS THIS
                *  ROUTINE.
                * CQ EXITS TO MORSE ID WHEN A ASCII PERIOD IS
                *  ENCOUNTERED IN THE BUFFER.
                * THE COLUMN COUNTER IS USED IN THIS ROUTINE.
                * BUFFER IS PLACED AT THE END OF THE RTTY PROGRAM
                *  TO ALLOW A BUFFER LENGTH LIMITED ONLY BY MEMORY
                *  SIZE.
044.100         CQ      ORG     44100A
044.100  315 304 042    CALL    $PLFCR
044.103  036 000        MVI     E,0Q       SET COLUMN COUNT=0
044.105  041 166 044    LXI     H,BUFFER
044.110  176    LOOP2   MOV     A,M
044.111  376 056        CPI     56Q        PERIOD-ASCII
044.113  312 200 043    JZ      MORSE
044.116  315 161 042    CALL    XMIT
044.121  043            INX     H
044.122  173            MOV     A,E        GET COLUMN COUNT
044.123  376 110        CPI     110Q       COMPLETE LINE?
044.125  302 110 044    JNZ     LOOP2
044.130  315 304 042    CALL    $PLFCR
044.133  036 000        MVI     E,0Q       SET COLUMN COUNT=0
044.135  303 110 044    JMP     LOOP2
                * LOAD BUFFER - THIS ROUTINE PERMITS CONSOLE TERMINAL
                *  TO LOAD BUFFER.
                * THIS ROUTINE IS MANUALLY ADDRESSED USING H8 FRONT
                *  PANEL (LOAD PC THEN GO).
                * END BUFFER TEXT WITH A PERIOD.  THIS WILL CAUSE
                *  A BRANCH TO THE RECEIVER ROUTINE.
044.140  315 152 040  LOAD    CALL    $PRSCL     INITIALIZE TERM. PORT
044.143  041 166 044          LXI     H,BUFFER
044.146  315 144 040  GETCH   CALL    $RCHAR     GET CHAR.
044.151  315 147 040          CALL    $WCHAR     ECHO TO CONSOLE
044.154  167                  MOV     M,A        MOVE CHAR. TO BUFFER
044.155  376 056              CPI     56Q        PERIOD-ASCII
044.157  312 153 041          JZ      RCVR1
044.162  043                  INX     H
044.163  303 146 044          JMP     GETCH
044.166               BUFFER  DS      200
                * MORSE ID
                * JAN. 10, 1979
```

```
                * THIS ROUTINE SENDS THE "READER ON" OR "READER OFF"
                * COMMAND WORDS TO PORT 101 TO KEY THE XMTR FOR MORSE
                * CODE IDENTIFICATION.
                * THE VOX HOLD ON THE SSB TRANSMITTER SHOULD BE
                * ADJUSTED SO THAT IT DOES NOT DROP OUT DURING THE
                * WORD SPACE INTERVAL.
                * CTRL-A WHILE IN THE XMIT MODE CAUSES A BRANCH TO
                * THIS ROUTINE.
                * THIS ROUTINE BRANCHES TO THE TRANSMIT MODE UPON
                * COMPLETION.
000.053               DLY      EQU     53A
043.200                        ORG     43200A
043.200  026 020      MORSE    MVI     D,20Q      LOAD NO. OF MORSE CHARS.
043.202  041 300 043           LXI     H,TABLE    CODE TABLE
043.205  176          NXTC     MOV     A,M
043.206  207          NEXT     ADD     A          SHIFT LEFT
043.207  312 240 043           JZ      SPACE      IS ACC. EMPTY?
043.212  365                   PUSH    PSW        SAVE CHAR.
043.213  322 227 043           JNC     DOT
043.216  076 200               MVI     A,200Q     LOAD DASH LENGTH
043.220  315 255 043           CALL    CODEGEN
043.223  361                   POP     PSW        RECOVER CHAR.
043.224  303 206 043           JMP     NEXT
043.227  076 053      DOT      MVI     A,53Q      LOAD DOT LENGTH
043.231  315 255 043           CALL    CODEGEN
043.234  361                   POP     PSW        RECOVER CHAR.
043.235  303 206 043           JMP     NEXT
043.240  076 200      SPACE    MVI     A,200Q     LOAD DASH LENGTH
043.242  315 053 000           CALL    DLY
043.245  043                   INX     H          INX MEMORY POINTER
043.246  025                   DCR     D          DEC CHAR. COUNT
043.247  302 205 043           JNZ     NXTC
043.252  303 100 042           JMP     START      GOTO TRANSMIT ROUTINE
                * CODEGEN SUBROUTINE -
043.255  365          CODEGEN  PUSH    PSW        SAVE A
043.256  076 007               MVI     A,7Q       TURN ON XMTR
043.260  323 101               OUT     101Q       SEND ON TO PORT
043.262  361                   POP     PSW        RECOVER A
043.263  315 053 000           CALL    DLY
043.266  076 047               MVI     A,47Q      TURN OFF XMTR
043.270  323 101               OUT     101Q       SEND OFF TO PORT
043.272  076 053               MVI     A,53Q      DOT LENGTH SPACE
043.274  315 053 000           CALL    DLY
043.277  311                   RET
                * MORSE CODE TO OCTAL CONVERSION TABLE:
                * A  140     O  360     2  074
                * B  210     P  150     3  034
                * C  250     Q  330     4  014
                * D  220     R  120     5  004
                * E  100     S  020     6  204
                * F  050     T  300     7  304
                * G  320     U  060     8  344
                * H  010     V  030     9  364
                * I  040     W  160     .  126
                * J  170     X  230     ,  316
                * K  260     Y  270     /  224
                * L  110     Z  310     ?  062
                * M  340     0  374
                * N  240     1  174
                * TWO "000" SHOULD BE USED TO GENERATE A
                * WORD SPACE.
                * THE NUMBER OF MORSE CHARACTERS INCLUDING
                * SPACES MUST BE ENTERED INTO PROGRAM  AT
                * 043.201 IN OCTAL.
043.300  220          TABLE    DB      220Q       D
043.301  100                   DB      100Q       E
043.302  000                   DB      0Q
043.303  000                   DB      0Q
043.304  160                   DB      160Q       W
043.305  004                   DB      4Q         5
043.306  040                   DB      40Q        I
043.307  050                   DB      50Q        F
043.310  330                   DB      330Q       Q
043.311  000                   DB      0Q
043.312  000                   DB      0Q
043.313  160                   DB      160Q       W
043.314  004                   DB      4Q         5
043.315  040                   DB      40Q        I
043.316  050                   DB      50Q        F
043.317  330                   DB      330Q       Q
```

the LTRS/FIGS mode must be shifted to FIGS before a return to the main program is executed. When the program is in the FIGS mode, the LTRS code (37$_8$) must precede the next LTR to be transmitted. After any printable character is transmitted, the column counter (E) is incremented before a return to the main program is executed. The utility subroutines $PFIGS and $PLTRS shown in Fig. 7 handle the LTRS/FIGS conversions and $SEND subroutine does the actual character transmitting. If upon return to the main program the column count is equal to 72 (width of a standard TTY terminal), a subroutine

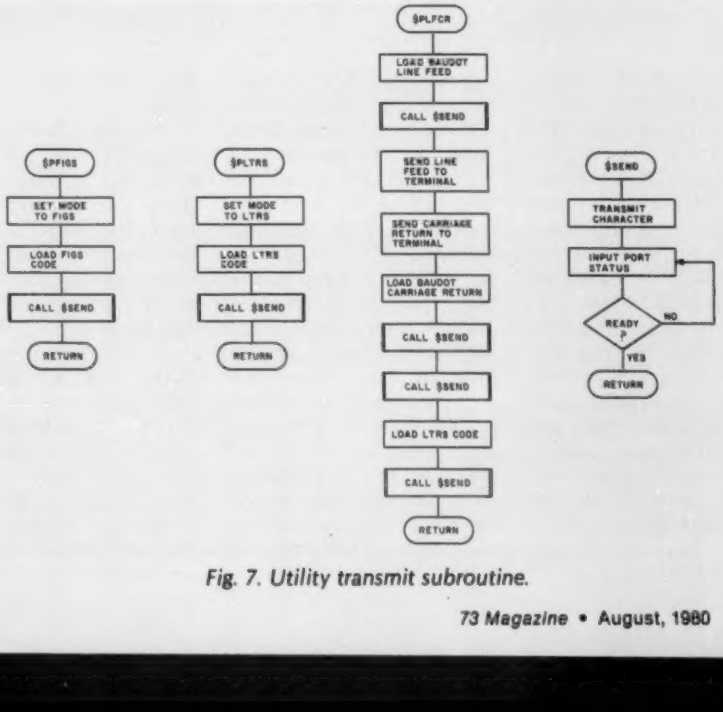


Fig. 7. Utility transmit subroutine.

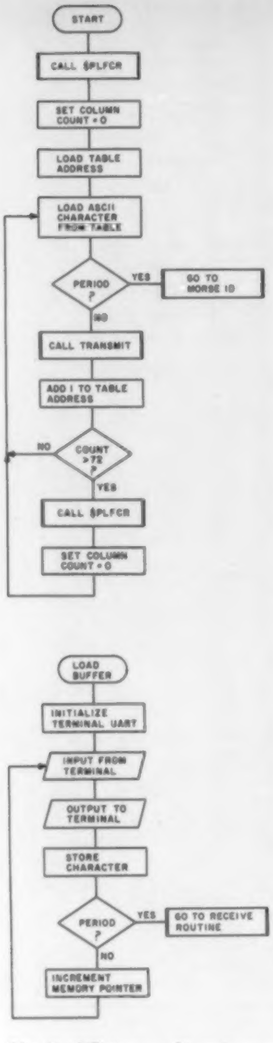

START
CALL $PLFCR
SET COLUMN COUNT = 0
LOAD TABLE ADDRESS
LOAD ASCII CHARACTER FROM TABLE
PERIOD ?
YES
GO TO MORSE ID
NO
CALL TRANSMIT
ADD 1 TO TABLE ADDRESS
COUNT >72 ?
NO
YES
CALL $PLFCR
SET COLUMN COUNT = 0
LOAD BUFFER
INITIALIZE TERMINAL UART
INPUT FROM TERMINAL
OUTPUT TO TERMINAL
STORE CHARACTER
PERIOD ?
YES
GO TO RECEIVE ROUTINE
NO
INCREMENT MEMORY POINTER

Fig. 8. CQ transmit program.

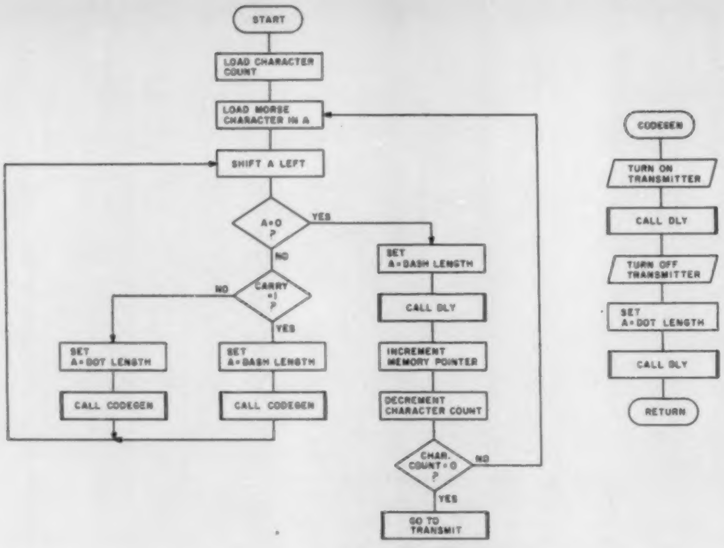

START
LOAD CHARACTER COUNT
LOAD MORSE CHARACTER IN A
SHIFT A LEFT
A=0 ?
YES
NO
CARRY =1 ?
NO
YES
SET A=DOT LENGTH
CALL CODEGEN
SET A=DASH LENGTH
CALL CODEGEN
SET A=DASH LENGTH
CALL DLY
INCREMENT MEMORY POINTER
DECREMENT CHARACTER COUNT
CHAR. COUNT=0 ?
NO
YES
GO TO TRANSMIT
CODEGEN
TURN ON TRANSMITTER
CALL DLY
TURN OFF TRANSMITTER
SET A=DOT LENGTH
CALL DLY
RETURN

Fig. 9. Morse ID program.

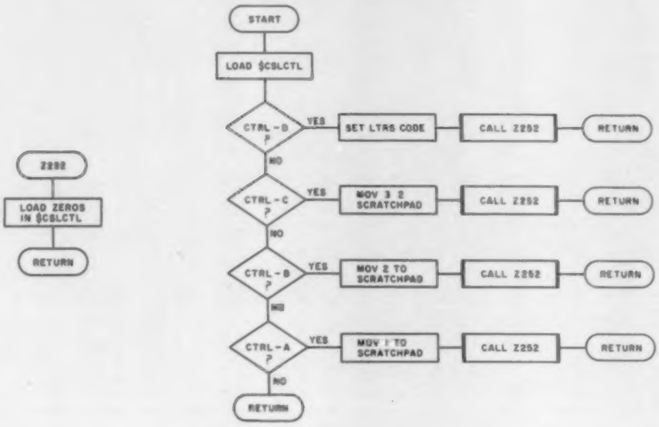

Z252
LOAD ZEROS IN $CSLCTL
RETURN
START
LOAD $CSLCTL
CTRL-D ?
YES
SET LTRS CODE
CALL Z252
RETURN
NO
CTRL-C ?
YES
MOV 3 2 SCRATCHPAD
CALL Z252
RETURN
NO
CTRL-B ?
YES
MOV 2 TO SCRATCHPAD
CALL Z252
RETURN
NO
CTRL-A ?
YES
MOV 1 TO SCRATCHPAD
CALL Z252
RETURN
NO
RETURN

Fig. 10. Control interrupt program.

$PLFCR is called. $PLFCR transmits line feed, two carriage returns, and the LTRS shift character. The two carriage returns allow mechanical printers time to return to column zero before text starts again. After executing $PLFCR, the program branches back to "set LTRS code" to begin another loop through the program.

The CQ routine, whose flowchart is shown in Fig. 8, first calls $PLFCR then sets the column count to zero. ASCII characters are then sent sequentially to the XMIT subroutine until a period character is encountered. When a period is encountered in the buffer, a branch to the Morse ID routine is executed. After each column count of 72, the $PLFCR subroutine is called. A special, manually-executed routine, LOAD BUFFER (beginning at 044/140), is used to initially load the buffer. This routine sequentially loads ASCII characters from the terminal into memory until a period is sent. The period is stored and then the program branches to the receive program. The CQ buffer is placed at the end of the RTTY program so that the length of the buffer is limited only by the memory size (less stack requirements).

The flowchart for the Morse ID routine is shown in Fig. 9. This program generates Morse code characters by interrupting the audio output of the RTTY interface using the "reader on/off" control line of the H8-2 parallel port. (A complete discussion of this Morse code storage technique can be found in Reference 4.) Each Morse character is represented from left to right, one bit per element, using 0 for dot and 1 for dash. At the end of the character, a 1 is placed as a stop bit; remaining bits are filled with zeros. A complete alphanumeric conversion table in octal appears in the source code listing of the Morse ID program. A word space is generated by using two all-zero characters. The number of Morse characters must be loaded in 043/201 in octal. The program sequentially loads characters from TABLE into the accumulator. Each character is shifted left using ADD A one place per loop and then the carry bit is tested. If the carry bit is not set, a dot is transmitted. If the carry bit is set, a dash is transmitted. When only zeros remain in the accumulator, a dash-length letter space is generated before the next character is loaded. The subroutine CODEGEN uses a subroutine DLY to generate dot and dash length time delays. DLY is part of Heath's H8 front panel monitor routine (in ROM) and uses the interrupt clock to generate time delays in milliseconds equal to twice the value of the accumulator.

Once the CQ buffer and the Morse ID tables have been loaded, the complete RTTY object program can be dumped onto a new tape preserving the custom tables.

Control Interrupt Program

The flow diagram for the CIP is shown in Fig. 10. Heath's H8 console driver program has interrupt processing for CTRL A, B, C, D, O, P, Q, and S. CTRL A, B, C, and D are available for user routines. When a CTRL A through D interrupt occurs, an identifying number is placed in $CSLCTL (040/252) and then a branch is executed to the user interrupt program found at the address labeled $CIS. The eight least significant bits of the address of the interrupt program (000_8) are placed in $CIS (040/250), and the eight most significant bits (044_8) are placed in $CIS+1 (040/251). The interrupt program tests the location $CSLCTL to determine which of the four CTRL interrupts has occurred. After either setting the LTRS code (CTRL-D) or moving one of the three numbers to a scratchpad, $CSLCTL is zeroed and a return executed.

Testing

The complete RTTY interface may be tested by tape recording the microphone output of the interface on an audio cassette recorder and then playing that signal back through the interface receiver. Perfect copy should result if everything is correct. The polarity of the system may be verified by the correct reception of amateur RTTY signals (usually found near 14.1 MHz) in the USB mode. ■

Partial Parts List

U1	—LM565CN phase locked loop—National Semiconductor
U2	—LM311H—National Semiconductor
U3	—AY-3-1015 UART—General Instruments
U4,U5	—LM555CN—National Semiconductor
U6	—CD4066AE—RCA
U7	—SN7473N—Texas Instruments
U8	—SN7400N—Texas Instruments
U9	—SN74LS365—Texas Instruments
U10,U11	—LM741CN—National Semiconductor
L1,L2	—85.5 mH (463 turns of No. 34 enamel wire on 1811P-A400-3B7 pot core—pot core from Ferroxcube)

References

1. *RTTY Handbook*, 73, Inc., Peterborough NH 03458, 1978, p. 17.
2. *Ibid*, pp. 65-66.
3. Robert Furtaw, ed., "Using the H8 Console Driver," *Remark*, No. 2, Heath User's Group, St. Joseph MO 49085, pp. 16-17.
4. L. Krakauer, "Efficient Storage of Morse Character Code," *Byte* 14, pp. 36-38, 1976.

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A Different Kind of Charger

— take a Gel/Cell to lunch

I have always been interested in rechargeable batteries and the means by which you can recharge these batteries. For instance, even the simple carbon-zinc dry cell can be recharged successfully to some extent using reverse current charging methods.[1] The nickel-cadmium battery is a sealed battery which was specifically designed to meet the need of having rechargeable battery power available for emergency and portable usage.

The nicad, while being much better suited for this service than the dry cell, still has some problems. Its low internal resistance allows it to supply much more current than a dry cell, but it requires considerable care when recharging to protect against permanent damage from overcharging. It also can be damaged by over-discharging the battery to the point that a single cell within it becomes reversed.

Depending on the application, nicads may not even go as long on a charge as a carbon-zinc dry cell. In fact, they tend to develop a "memory" of how long they are usually used and they will go dead before their Ampere-hour (Ah) rating says they should.[2] This can usually be corrected by cycling the battery through several complete discharge/recharge cycles, but it is time consuming and, if you forget and let it discharge too long, you may be looking for a new nicad. And nicads are quite expensive, being made of silver, nickel, and cadmium.

On the other hand, there is a new kid on the block with quite a bit to offer. The gelled electrolyte battery, or Gel/Cell™ as Globe-Union, Inc., of Milwaukee, Wisconsin, chooses to call their product, seems to

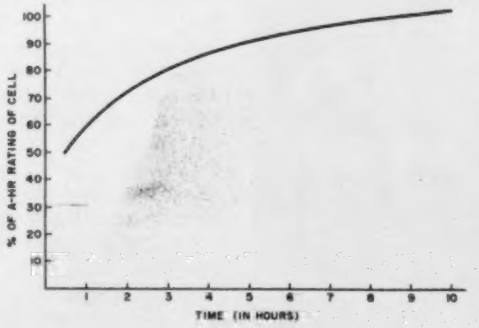
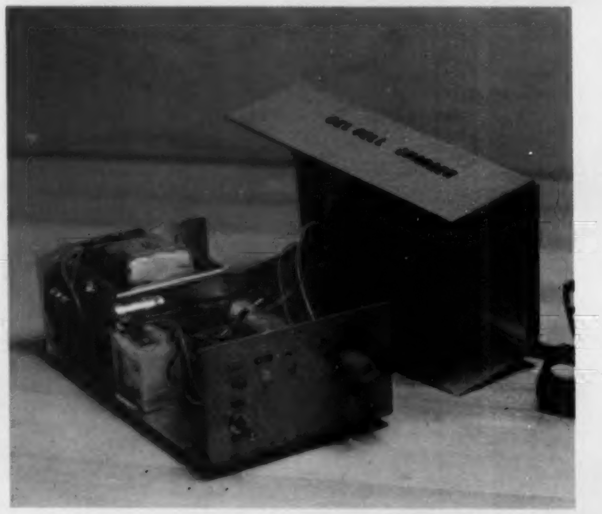


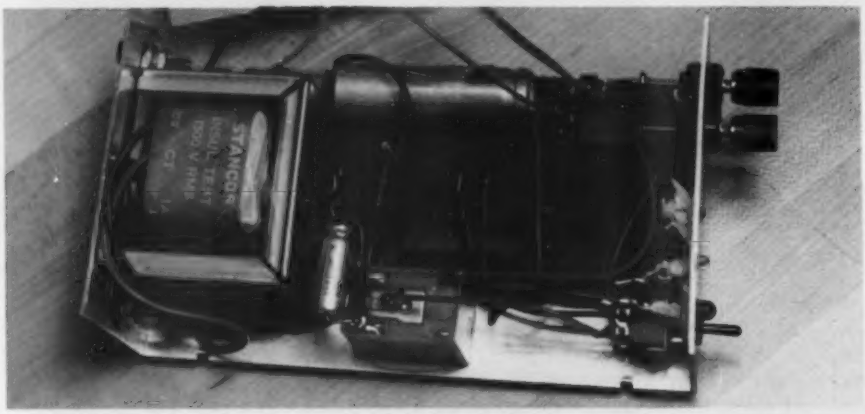
Fig. 1. Ampere-hour (Ah) rating vs. discharge time. The graph shows the approximate percentage of Ah capacity available when a Gel/Cell is discharged in less than the rated 20-hour time period. Note that capacity is nearly 100% above 10 hours. For example, a 4.5-Ah battery would be worth about 70% of its rated capacity when discharged in two hours. Seventy percent of 4.5 = 3.15 Ah for two hours, or about 1.575 Amps.



Gel/Cell charger with lid off.

gel/cell
GLOBE RECHARGEABLE BATTERY
GEL CELL CHARGER

Charger, Gel/Cell, and iron.



Top view of charger.

SOLDERING STATION

Charger in "homemade" case.

have the best of both worlds.

The Gel/Cell is essentially a lead-acid battery like the one you use in your car except that the electrolyte is in a gelled state rather than a liquid. The battery is sealed so there are no liquid levels to check and no other routine maintenance to perform. They can be mounted in any position so they are ideally suited for use in medical equipment, tape recorders, or any piece of portable equipment that may be placed in unusual positions.

The Gel/Cell is comparable to the nicad in many ways, if not superior. It can be recharged over and over, 200 to 500 or more complete charge/discharge cycles or more. And the Gel/Cell does not suffer permanent damage from being totally discharged as does the nicad with its cell-reversal problem. So, if you accidentally leave your equipment on for two weeks, the batteries will come back. The Gel/Cell has a high current discharge ability like the nicad. Globe-Union's little GC 210, a 2-volt, 0.9-Ah battery, will put out 15 Amperes continuously for 1 minute!

The Gel/Cell is far above the nicad in many ways. It has no memory problem. You can use just 2% of its capacity for years and when you want 100%, it's there. You do, however, have to develop that capacity. Under cyclic conditions, the capacity of the battery actually increases until, after about 20 cycles, the full capacity is reached. Once developed, that capacity is retained over a long period of time.

Gel/Cells can be competitively priced since they are made of lead primarily. They may be series- or parallel-wired to obtain any desired multiple of 2 volts or current rating. That brings up another interesting point. The Gel/Cell puts out 2 volts, so it takes fewer cells to make a given voltage.

In storage, they lose from 2 to 3% of their charge per month at room temperature. Other batteries may lose as much as 20-40% under the same conditions. Or, if kept on a "floating" voltage of 2.25 to 2.3 volts per cell, they can be kept for years ready to provide emergency service and will recharge themselves automatically.

Globe-Union's Gel/Cells are rated in Ampere hours at a 20-hour rate. In other words, a 12-volt, 4.5-Ah battery will supply 225 mA for 20 hours (225 mA × 20 hours = 4.5 Ah). The discharge curves are fairly linear, with most smaller batteries giving 60-70% of their rated 20-hour capacity when discharged in one hour. For example, the battery mentioned above will supply 3 Amperes for one hour, 1.75 Amperes for 2 hours and about 1 Ampere for 4 hours.[3]

Having acquired a Globe GC 1245 Gel/Cell, I wanted to put it to work running a Weller constant-temperature tip, 12-volt soldering iron for portable use. (This is the battery I was describing above.) A word here about what I observed of Globe's numbering system for their batteries. The letters "GC" seem to indicate "Gel/Cell" and the numbers are the voltage and Ah rating of the battery, in that order. So, GC 1245 is a Gel/Cell with a 12-volt terminal voltage and a 4.5-Ah rating at a 20-hour rate. GC 811 is an 8-volt battery at 1.1 Ah, etc. For an approximation of Ampere-hour capacity for other than the 20-hour rate, see Fig. 1.

The Weller iron draws about 3 or 4 Amps when heating and nothing when the desired temperature is achieved, so it should be able to run for about an hour using the GC 1245. Not bad. Now we need to look at the Gel/Cell's recharge characteristics.

Globe-Union gives some specific data on how to charge their Gel/Cells for optimum life (maximum number of cycles). The normal open-circuit voltage of a single cell is 2.12 volts. That's 6.36 volts for a "6-volt" battery (3 cells), 8.48 volts for an 8-volt battery, and 12.72 volts for a 12-volt battery, etc.

To recharge a battery to full charge, apply a dc voltage greater than the open-circuit voltage of the battery to the input terminals of the battery. The maximum current to the battery should be limited to about one-sixth the Ah rating of the battery. (See Table 1.)

As the battery begins to charge, the voltage at the terminals will rise. The voltage should be kept at a maximum of 2.4 volts per cell until the current through the cell (with 2.4 volts per cell applied) drops to about 2% of the Ah indicated current (see Table 1). When this condition is reached, the battery should be removed from the charger or placed on a "floating" charge voltage to prevent damage from overcharging.

The floating-charge voltage for a Gel/Cell is about 2.25 to 2.30 volts. When kept at this voltage, the battery will seek its own current requirement and maintain itself in a fully-charged condition. It can, at this voltage, also fully recharge itself after a loss of power. It will, however, take longer to reach a fully-charged state at this lower voltage.

There also may be some decrease in the total number of charge/discharge cycles when compared to batteries charged at the higher voltage. Globe-Union uses the term "floating voltage" instead of the term "trickle charge," as used with nicad batteries, since trickle charge infers a constant current charge with the cell seeking its own voltage. The floating-voltage method allows the Gel/Cell to draw the current necessary to satisfy itself.

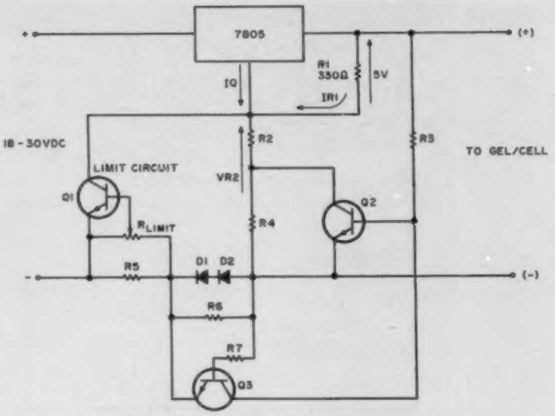


Fig. 2. Basic Gel/Cell charger.

BATTERY RATING (Ah)	MAXIMUM CHARGE CURRENT (mA)	END OF CHARGE CURRENT (mA)
.9	150	10-20
1.5	250	20-40
1.8	300	20-40
2.6	400	30-60
4.5	700	50-100
6.0	900	60-120
7.5	1200	80-160
20.0	4 Amps	100-300

Table 1. Maximum initial charge current and end of charge indicator.

The floating-voltage method is preferred since there is the possibility of overcharging the battery if you use the "trickle" method. Again, if it is necessary to obtain the maximum number of cycles from the battery, it should be current limited to 2.4 volts per cell and held there until full charge (as indicated by the current in Table 1) is reached and then switched to a float voltage of 2.25 volts per cell.

Well armed with this knowledge, I set out to design a charger that would allow me to get the maximum service from my Gel/Cell. I wanted to use a minimum of parts, but wanted it to be fully automatic and still meet the required specifications.

For my 12-volt Gel/Cell, the specs were as follows:

Maximum current = 700 mA.

Maximum voltage = 14.4 (2.4 V × 6 cells = 14.4).

Full charge current = 50-100 ma.

Float voltage = 13.5 Volts (2.25 V × 6 cells = 13.5).

I chose the 78xx/LM340T-xx series of 3-terminal voltage regulators as the starting point since they are current limited and have internal thermal protection. They have a fairly constant current through the common or ground terminal of about 5 or 6 mA, which allows them to be used as an adjustable regulator with the addition of a minimal number of parts. I chose a five-volt regulator since they are easy to come by, and by pulling the ground pin low, the output will drop to 5 volts, which should be sufficient to limit the current to less than 700 mA.

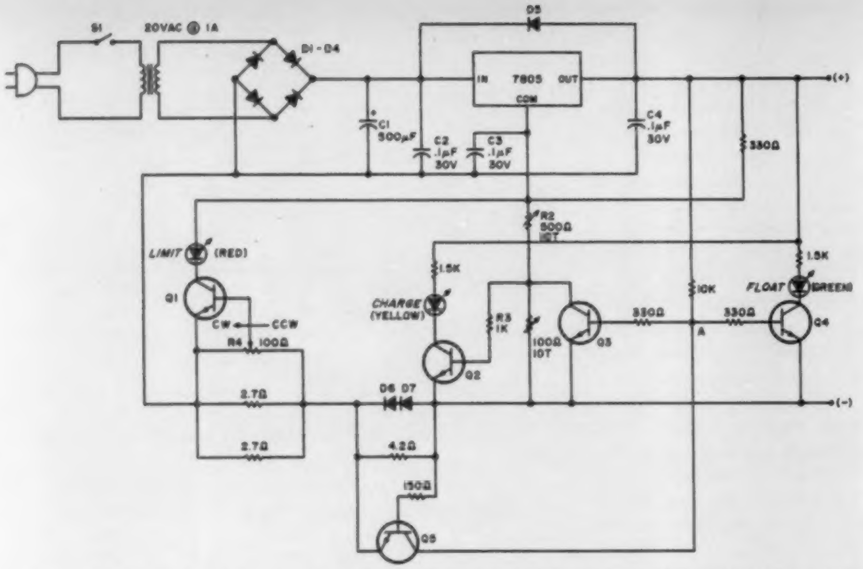


Fig. 3. Finished Gel/Cell charger. Notes: C2-C4—.1 uF, 30 WV or greater; D1-D7—1 Amp or greater at 50 piv or greater; resistors are ¼-Watt unless otherwise specified in the text; Q1-Q5 are 2N2222 or equivalent.

Refer to the circuit of Fig. 2. A fairly constant current is supplied to R2 from the 7805 and the 330-Ohm resistor. That current flows through R2 and R4 causing the ground pin on the regulator to be raised and also the output of the regulator. When the current through the R6-D1, D2 combination is low enough to turn off Q3, as indicated by the end of charge current, then Q2 turns on, pulling the R2-R3 junction to about 0.2 volts above the output (−) lead. R2 can be calculated:

VR2 = Float voltage − regulator voltage − Q2Vce (sat) = 13.5 − 5.0 − 0.2 = 8.3 volts. R2 = VR2/IR2 = 8.3/(5 mA + 5 V/330 Ω) = 8.3/20 mA = 415 Ohms (approximately).

R4 is calculated in much the same manner: VR4 = Charge voltage − regulator − VR2 = 14.4 − 5.0 − 8.3 = 1.1 volts. R4 = 1.1 V/20 mA = 55 Ohms (approximately).

Assuming that Q2 has an hfe of 50 or more, then I chose R3 to be about 25 times R2 to allow Q2 to be fully turned on with Q3 off: R3 = 25 × 400 = 10k.

Q3 is a silicon transistor which stays on as long as the base-emitter voltage is above .5 or .6 volts. While it is on, it holds Q2 off, and the regulator is giving the hard-charge voltage of 14.4 volts. R6 is chosen so that with about 100 mA through the battery, there is just enough voltage to keep Q3 on. R7 limits the current through the base-emitter junction of Q3 to less than 5 mA. D1 and D2 are two forward-biased silicon diodes which limit the voltage across R6 to about 1.6 volts for currents much greater than 100 mA. R6 can be calculated: R6 = 0.5 V/100 mA = 5 Ohms.

R5 is selected so that at maximum allowable current the voltage across it will be more than enough to turn on Q1 which, in turn, pulls the output voltage down. R5 also should be small enough so that the drop across it will not be considerable, either. I chose 1 volt at the rated current of 700 mA: R5 = 1 V/700 mA = 1.42 Ohms.

Final Touches

The 7805 is current limited and thermally protected, but don't forget to put it on some kind of a heat sink or enough heat will build up and it will protect itself, turning off the charger. Check the wattage rating on those resistors carrying a lot of current. Quarter-watters are fine for everything but R5 and R6. For those use:

For R5, $P = I^2R$, where I^2 is the maximum current squared. $P = (.7)^2(1.35) =$ 0.66 Watts or 0.33 Watts for each 2.7-Ohm resistor.

For R6, $P = E^2/R$, where E^2 is the forward drop of D1 and D2 squared. $P = (1.6)^2/5 = 0.51$ Watts. One Watt of dissipation is indicated. Also use usual precautions such as bypass caps.

Fig. 3 is the finished working model of my charger for my Globe-Union 1245 Gel/Cell. Adjustment is fairly simple.

With no battery attached, adjust R2 for the floating voltage of 13.5 V dc (2.25 volts/cell × 6 cells = 13.5 volts). Next, adjust the full-charge voltage by jumpering point A to the emitter of Q3 and adjusting R3 for an output voltage of 14.4 V dc. (2.4 volts/cell × 6 cells = 14.4 volts.)

The current limit control, R4, is a little more difficult to set. I set the control to full counterclockwise, then connected the battery, with an ammeter in series with the battery, to the charger. A partially discharged Gel/Cell will draw in excess of the maximum allowable charge current from an unregulated supply, so all you need to do is turn the limit control until the meter indicates 700 mA.

The charger is ready for service. Connect the Gel/Cell and watch the lights. The yellow LED indicates the battery is charging. If the red LED also is on, you know that the charger is limiting and you can expect the terminal voltage to be below 14.4 volts. As the fully-charged condition nears, the red LED will go out and the voltage will reach 14.4 volts. When full charge is reached (charge current below 100 mA), the yellow LED will go out as the green one comes on.

This circuit has been in use for some time now with a 12-volt soldering station. It works very well, and it is so nice not to have to worry about handling the battery charging. It really takes care of itself.

Gel/Cells are very handy to use and quite durable, too. More and more are showing up on the market from the surplus houses now, so why not pick one up and enjoy real trouble-free battery operation? ■

References

1. "A Simple Reverse Current Battery Charger," W6FPO, *73 Magazine*, October, 1973, p. 55.
2. "Making Nicads Behave," K2OAW, *73 Magazine*, December, 1974, p. 33.
3. For more information on Gelled Electrolyte batteries, contact Globe Battery, Division of Globe-Union, Inc., 5757 North Green Bay Avenue, Milwaukee WI 53201, (414)-228-2394.

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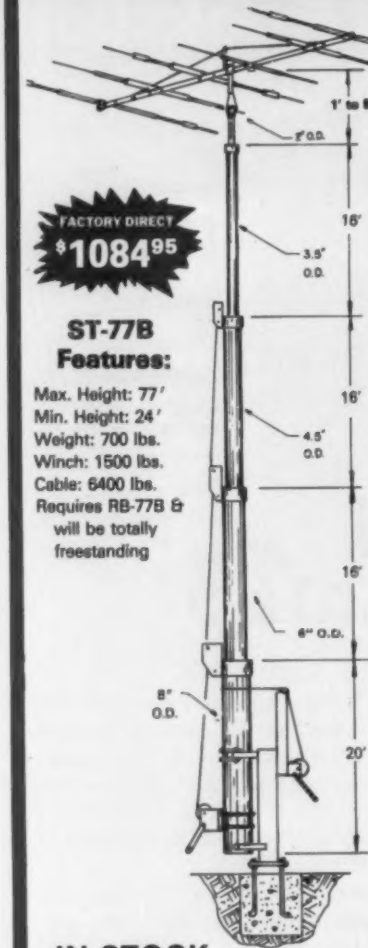

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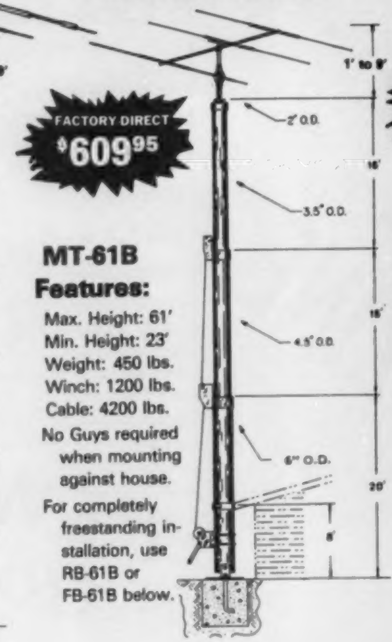

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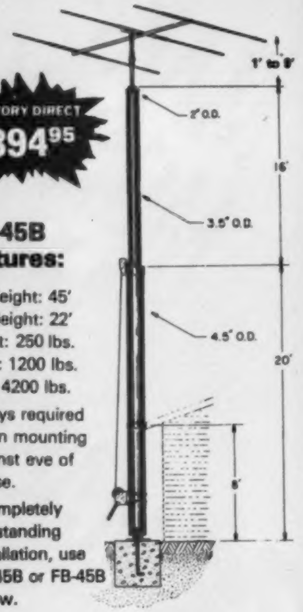

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MT-61B	53	18	
	61	12	
TT-45B	37	18	
	45	12	

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TOWER	WIDTH	DEPTH
TT-45B	12" x 12"	30"
FB-45B	30" x 30"	4½'
RB-45B	30" x 30"	4½'
MT-61B	18" x 18"	4'
FB-61B	3' x 3'	5½'
RB-61B	3' x 3'	5½'
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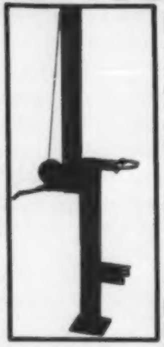

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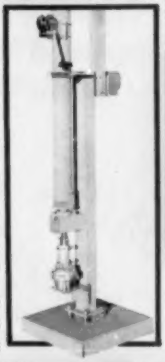

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SPECIFICATIONS

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- Two High-Q traps with large diameter coils
- Low angle radiation
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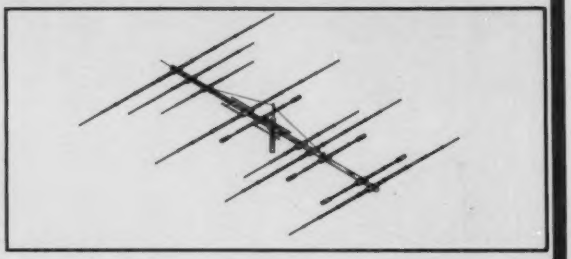
- 5 elements on 10 mtrs

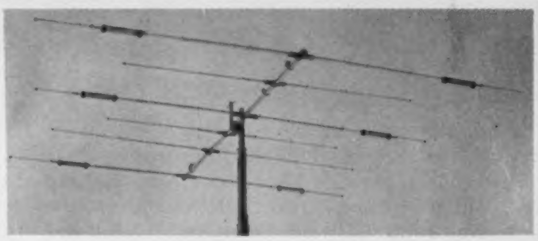


The System 40A is the answer to the DXer who does not have space to stack monobanders yet wants the advantages they offer. Through the use of a switchable matching unit, only one feed line is required and complete coverage of both the phone and cw bands are available with only one setting.

Max. Pwr. Input	Legal Limit	Matching Method	Split Beta	Surface Area	12.1 sq.ft.
VSWR @ Res.	1.2:1	F/B Ratio	25 db	Wind Loading @ 80 mph.	309 lbs.
Impedance	50 ohm	Boom	2″ x 26′	Assem. Weight	75 lbs.
Feed Method	Balun Supplied	Longest Element	36′	Shipping Weight	84 lbs.
Gain10 dBd on 15 & 20 — 11.5 dBd on 10		Turning Radius	22′6″		

SY-36

$\$219^{95}$



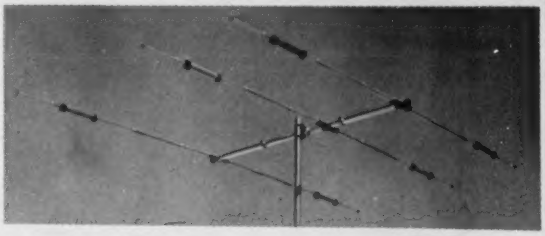
A trap loaded antenna that performs like a mono-bander! That's the characteristic of this six element three band beam. Through the use of wide spacing and interlacing of elements, the following is possible: three active elements on 20, three active elements on 15, and four active elements on 10 meters. No need to run separate coax feed lines for each band, as the bandswitching is automatically made via the High-Q Wilson traps. Designed to handle the maximum legal power, the traps are capped at each end to provide a weatherproof seal against rain and dust. The special High-Q traps are the strongest available in the industry today.

SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x Length)	2″ x 24′2⅛″	Wind Loading @ 80 mph.	215 lbs.
Maximum Power Input	Legal Limit	Number of Elements	6	Maximum Wind Survival	100 mph
Gain (dBd)	Up to 9 dB	Longest Element	29′6⅛″	Feed Method	Coaxial Balun (Supplied)
VSWR @ Resonance	1.3:1	Turning Radius	18′6″		
Impedance	50 ohm	Maximum Mast Diameter	2″	Assembled Weight (approx)	53 lbs.
F/B Ratio	20 dB or better	Surface Area	8.6 sq. ft.	Shipping Weight (approx.)	62 lbs.

SY-33

$\$164^{95}$



Capable of handling the Legal Limit, the SYSTEM 33 is the finest compact tribander available to the amateur. Designed and produced by one of the world's largest antenna manufacturers, the traditional quality of workmanship and materials excels with the SYSTEM 33. New boom-to-element mount consists of two 1/8″ thick formed aluminum plates that will provide more clamping and holding strength to prevent element misalignment. Superior clamping power is obtained with the use of a rugged 1/4″ thick aluminum plate for boom to mast mounting. The use of large diameter High-Q Traps in the SYSTEM 33 makes it a high performance tri-bander and at a very economical price. A complete step-by-step illustrated instruction manual guides you to easy assembly and the lightweight antenna makes installation of the SYSTEM 33 quick and simple.

SPECIFICATIONS

Band MHz	14-21-28	Boom (O.D. x Length)	2″ x 14′4″	Wind Loading @ 80 mph.	114 lbs.
Maximum Power Input	Legal Limit	Number of Elements	3	Assembled Weight (approx)	37 lbs.
Gain (dBd)	Up to 8 dB	Longest Element	27′4″	Shipping Weight (approx)	42 lbs.
VSWR at Resonance	1.3:1	Turning Radius	15′9″	Direct 52 ohm feed	No Balun Required
Impedance	50 ohm	Maximum Mast Diameter	2″ O.D.	Maximum Wind Survival	100 mph
F/B Ratio	Up to 20 db	Surface Area	5.7 sq. ft.		

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Roswell GA 30075

"No Problem . . . No Problem"

— tales of DX contesting with VP2KC

This is not the official story of the VP2KC world-record contest team. That story will be written by others, and since CQ *Magazine* sponsored the contest, will almost certainly be published there. I was just one of the operators, and this is my story.

For those who are not avid contest followers, the Southeastern DX Club and friends put together a serious multi-multi operation from VP2KC during the sideband part of the CQ-WW contest in October, 1979. The organizers of this effort were shooting at PJ9JR's world record of 29 million points. Now, as everyone knows, VP2KC is on St. Kitts, St. Kitts is in North America, and contacts within North America count only two points. So all those U.S. QSOs count only two points for us, but three points for our competitors a few miles to the south, because their island is considered to be South America. So, what chance did we have? The organizers must have been crazy! Everyone knows you can't even win this contest from a two-point country, let alone think about world records. But I guess they knew something that everyone else didn't, because at 2400Z when the bands went quiet, we had 37.7 million points, a new world record, and a real proud feeling.

PRINAIR
N577PR

One of Prinair's finest. (Photo by WA4PBW)

This whole thing got started in the spring of 1979 when Hugh Valentine N4RJ and Paul Newberry N4PN hooked up with Ellis "Kit" Carson VP2KC. Kit is a retired businessman from Indiana who isn't really retired. When one thinks of retired businessmen living in the Caribbean, the picture that comes to mind is some doddering old fool who

Spacious interior of a Prinair wide-body. This is one of the few airlines where you can get both a window and an aisle seat at the same time. (Photo by WA4PBW)

spends his days on the veranda watching the sugar cane grow. Well, that's not Kit. He makes frequent trips to the States for both business and pleasure in his private plane, is involved in countless activities, and is an influential member of the St. Kitts Board of Tourism. The idea of having a world-class contest station appealed to Kit, so Paul and Val made a trip to St. Kitts to explore the possibilities.

What they found can only be described as a DX contest paradise. Kit has a spacious estate with ample room for any and all kinds of antennas. There is an unobstructed water path to Asia, the States, Europe, and Africa, and a fairly good shot to the Pacific. There's a mountain to the south, but this turned out not to be a problem. Also, considering the main house and the surrounding cottages, there was room for six stations without crowding. But if anyone thinks that, having found the place, they forgot about it until contest time, let me assure you that this was not the case. The work started then.

Enter Ernie K1PBW. Ernie is one of the finest low-band operators in the world. If you doubt it, check some of the recent contest scores. But, more importantly, Ernie is a technical wizard. Between spring and the contest, Ernie spent more than fifty days on the island. He personally rewired the whole estate. The old electrical system just wasn't up to the task. On a good day, line voltage dropped 25 volts when Kit keyed his Drake linear. That was on a good day. When Ernie finished, six full power stations could operate, and you could barely tell from the line voltage if they were idling or transmitting. And, just in case the local power failed, there was a 17 kW diesel generator rigged up to be on line within thirty seconds. One stumbling block out of the way.

But Ernie also knew antennas. There were more low-band antennas than many people could even keep track of. The 160-meter transmitting antenna was a real masterpiece. A separate 116-foot tower was devoted to this purpose—counting the mast at the top, 132 feet of radiator. But that was only the part you could see. There were 18,000 feet (you read it right) of radials. That's about three and a half miles of radials! It took ten men ten days to bury them—one hundred man-days in the radials. A fair number of people commented that VP2KC was the loudest Caribbean station they had ever heard on 160. Now they know why.

The 75-meter transmitting antenna was also Ernie's work. It was a five-element phased vertical array. I doubt that anyone made scientific measurements of gain or directivity, but the 75-meter operators swore by it. On the other hand, Kit's wife, Annie Green, swore at it. It wasn't especially unsightly, but it was located right in the middle of her golf course. Between the verticals, the guys, and the feedlines, the green was just about unusable. Fortunately, Kit prevailed, and the array stayed in place. However, it was gone before noon the day after the contest. I hope that everyone who needed St. Kitts on 75 got it during the contest.

W3BTX
W4GIW
W4HR
W4LVM
N4NX
JA3ODC
K3OIH
K1PBW
WA4PBW
K4PHE
K4PI
N4PN
K5PP
W4PPT
WD4RCO
N4RJ
WB4RUA
K4UEE
N5UR
AA4V
N4WW

Table 1. Operator list.

Band	Raw QSOs	Zones	Countries
160	547	11	47
80	1150	22	95
40	1730	28	109
20	4520	39	153
15	5760	39	145
10	5100	35	128

Table 2. Statistics. Notice how close we came to 5-band DXCC in one weekend.

The pre-contest briefing took place on the VP2KC patio. (Photo by WA4PBW)

And then there were the receiving antennas. The tremendous Caribbean QRN made the verticals next to useless for receiving. So Ernie installed a series of Beverages for receiving on both 160 and 75. Some had as much as a quarter mile of feedline, with remote preamplifiers. I'm not sure exactly how many there were, but knowing how Ernie does things, I am sure that there was at least one directive, low-noise receiving antenna pointed at every area of the world where low-band activity was expected, and probably a few spares for good measure. Also, there were dipole spotting antennas—at least one per station. Remember the three and a half miles of radials? Think about how much coax there must have been! I've got to believe that the Belden and Amphenol stockholders must have been real pleased with their dividends.

But we're not finished with Ernie yet. By my count, there were 24 pieces of Drake B and C line equipment—receivers, exciters, and transceivers. Ernie modified all of them with the full range of Sherwood contest goodies and with a few of his own. With six stations in close proximity, there was essentially no cross-station interference. But most amazing to me was the spotting equipment. On any given band, the spotter, who was in the same room with the operator, could tune to within a few kHz of the transmit frequency with absolutely no problem. This alone was probably worth several multipliers. There was not a single equipment failure during the contest, and most of the credit goes to Ernie. If you're getting the idea that the whole thing would have been impossible without Ernie, I think you're right. Those fifty days on the island were very busy ones, I'm sure.

So the other guys stayed in Atlanta and loafed, right? Wrong! Who do you suppose arranged for the operators, the towers, the beams, the wire, the radios, the parts, the transportation, the accommodations, the scheduling, and the etcetera? The etcetera list is about a page long and extends down to the pencils and the scratch pads. All it takes is one missing etcetera to really screw up the whole works. Val N4RJ is a dentist who probably could have made a fine salesman. If you don't think it takes salesmanship to convince 29 operators to spend a thousand dollars each to go to St. Kitts (St. what??) in chase of wild geese, you should try it sometime. But remember, you're going to need more than 29 sales. If you want 29, then get solid, "swear-on-their-Granny's-grave" commitments from 49. Besides the sales effort, Val, Paul, and Bob K4UEE all made at least one pre-contest trip to the island. The rest of the towers and beams were their work.

There were others who made significant contributions. Bob W4HR was in charge of the operating plan. We knew well in advance just exactly what countries and zones, on what bands, and what hourly QSO rate, by band, it was going to take for the record. Bob passed the plan along to Mike K4PI. In all cases where Mike saw that a particular country was needed and no avid contesters were known to be active in that country, an attempt was made to arrange a schedule. I know at least a hundred letters went out, and it may have been several hundred. This was an ongoing process. As schedules materialized or failed to materialize, the operating plan was refined and amended.

Van W4GIW is associated with a travel agency. As operator commitments were received, Van arranged for their transportation and accommodations. The rates were much more favorable than we could probably have worked out as individuals. GIW, GIW . . . where have I heard that before? Must be PJ9GIW from 1973. That was a world record, too. And most of the people I've already mentioned were participants in that one. At least I'm not getting mixed up with a bunch of rookies here.

The weeks went by, and soon it was time for some important decisions, like whether or not my wife Pat was going. First she said no, and then maybe, and then yes. And by departure time, I couldn't have kept her away with a cannon. About ten of the wives were going, and she planned to enjoy herself whether or not I was going to be foolish enough to waste a whole weekend with those silly radios.

Both of us had busy work schedules, so we couldn't leave until the Thursday before the contest . . . very early Thursday, I might add. We had a 6:00 am flight, and a 4:00 am wake-up time comes so, so early. That was our first mistake. Our next mistake had to do with the clothes we wore. It was unusually cold in Atlanta, but we knew it would be very warm on St. Kitts, so we compromised with medium-weight clothes. As we stood shivering in the pre-dawn cold of the parking lot at the Atlanta airport, we had a good while to regret that decision while we waited for the shuttle bus.

But that was soon behind us. On board the Delta wide-body, we met Winston WA4PBW, who was to be the group's official photographer. Several of the photos you're looking at are Winston's work. Also on board were John WB4RUA and his charming friend Diane. The flight to San Juan was smooth, on time, and enjoyable. It was also the last enjoyable experience with an airline for some time, as we were about to encounter Prinair.

We had plenty of time in San Juan to have a few drinks, wander through the duty-free shops, and check in with Prinair. The first surprise came when John had to luggage-check the linear he was hand-carrying and I had to check the power supply I was carrying. At least the ladies got to keep their purses. The next surprise came when the agent asked each of us our weight and dutifully recorded it. It really wasn't much of a surprise when we got to the gate and were advised that the flight would be "somewhat delayed." When we finally got to board, I was thinking that maybe it should have been delayed somewhat more. The aircraft was a decrepit twin-engine clunker of dubious manufacture. Sure enough, we lost an engine en route to St. Thomas.

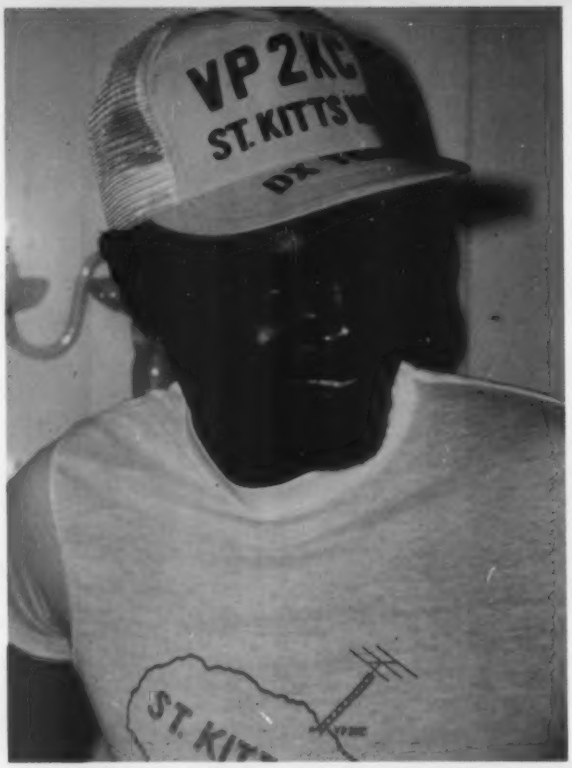
The 10-meter station—W4LVM is operating, WD4RCO is logging, and K5PP is spotting. (Photo by K4PHE)

So, another delay. "No problem," the pilot assured us. We were soon to learn that Prinair didn't really consider any passenger inconvenience to be a problem. Depends on your perspective, I'm sure. At least the air conditioner and the Coke machine in the Prinair lounge worked, so we made the best of it. Bob K4UEE and his wife Mary had left the day before so they could spend a little time in St. Thomas, and they were there when we arrived. The plan was for them to join us for the rest of the trip to St. Kitts. But when the replacement aircraft was ready to board, the pilot decided that he had enough passengers. "No, No. I come with sixteen, I leave with sixteen," said the pilot. We waved good-bye to Bob and Mary, who were having a heated discussion with the Prinair folks. Confirmed reservations are included among the variety of things that present no problem to Prinair.

Fortunately, both engines worked on the leg to St. Martin. There was another short delay there, but basically the trip was without further incident until we arrived in St. Kitts. You may recall the clothes that weren't warm enough in Atlanta. Well, from San Juan on south, they were far too warm, and I was really looking forward to a shower and fresh clothes in St. Kitts. To this day, I can't even begin to describe how I felt when we discovered that Prinair left the luggage in San Juan. "No problem," they assured us. Ah, jeez!!

Although we were hours late, our cab drivers were right there waiting. We piled into Mr. Coker's cab and headed for the Fairview Inn. At that point, I was so tired and discouraged that I remember almost nothing about the ride, except that there was a woman from Chicago who rattled on about nearly everything to no one in particular. Funny how memory works. When we registered at the Fairview, I was handed a red plastic bag containing a yellow VP2KC contest team hat, some paperwork, and a contest team T-shirt. A clean T-shirt!! Well, I got my shower and half a change of clothes. Alas, all Pat got was a shower, but no change of clothes. Like they say, half a loaf . . .

What with all the delays, we were far too late for Kit's pre-contest party. I'm told it was quite an event. The Premier was there, as were the Communications Minister, several other St. Kitts dignitaries, and nearly all of the local hams. I was really sorry to have missed it. So what did we do? We sat around the pool and enjoyed several Fairview Specials, a delicious rum punch. Pat and I were not alone in our plight. Austin



Were the island authorities in our corner? This is Z.A. "Zeff" Joseph, the St. Kitts Communications Minister. (Photo by WA4PBW)

N4WW and Steve AA4V were also without luggage. I think Winston may have lost his as well, but at least he had a few essentials in his camera bag. A few more Fairview Specials and a delicious dinner later, I was no longer tired or discouraged. I was ready to work DX!

Jack W4PPT strung up a dipole from the windmill tower and we were in business. Fred Lam, the Fairview owner, is both a gracious host and very kindly disposed toward hams. Arrangements were made so that we could operate all night without disturbing anyone. It's really fun to be on the other side of the pileup. It's also a great pleasure to operate below the American phone band where the DX is at. And so we went at it until the wee hours. When we finally quit, I wondered how I was going to make it back to the room, since it was pitch black outside. Then a man in a white uniform popped out of the bushes with a flashlight in one hand and a club in the other hand. As soon as he recognized me as a guest, he escorted me to the room, lighting the path with his flashlight. I'm sure glad he did recognize me, since that was a mighty big club and I suspect he used it for something besides balancing the flashlight.

After a day like that, I would have expected to sleep till noon, but for some reason, both Pat and I were up early—before they began serving breakfast, in fact. So, we just wandered around the grounds, enjoying the natural beauty. St. Kitts is really a beautiful island, and Fred Lam evidently takes great pains to preserve that beauty. The foliage is breathtaking, but not ostentatious. It's difficult to describe, but there's a world of difference between formal gardens that look like they were planted there and a natural setting where the trees and flowers look like they belong there. At the Fairview, everything looks like it belongs. And I don't recall seeing a single neon sign. I remember thinking that I could probably get used to the idea of never going back to Atlanta.

But, back to reality and more pressing matters—a call to Prinair to find out about the luggage and reconfirm the return trip. "No problem, sir. It will be on the morning flight." Well, OK. Relax and enjoy. Not much else we could do. As it turned out, there was no morning flight. A few more phone calls, and we learned that the FAA had grounded Prinair. But, "No problem, sir. One of the other airlines will bring it." Ah, jeeez! Arrrgh!

So, we went into town to buy essentials. Our contest T-shirts and VP2KC contest team hats made us instant celebrities. N4PN, N4RJ, and K1PBW had been interviewed on local television a few days before, and W4PPT had addressed the Rotary Club. And, of course, the Premier's attendance at the pre-contest party had been well publicized. Most of the people didn't really grasp what a DX contest is (do they anywhere?), but they seemed to be genuinely happy we were there. Thirty minutes later, we had toothbrushes, toothpaste, new clothes, and a rented car. Another shower, fresh clothes, and we were ready for anything. Simply amazing how a little thing like a toothbrush can brighten your day.

Besides missing the pre-contest party, those of us without luggage had missed not only the last-minute preparations, but the pre-contest fun as well. Even though I wasn't there to enjoy it personally, the following episode bears repeating. Obviously, the direct quotes shown are not really direct quotes, but I think I've captured the essence of the QSO between N4NX and Unnamed Competitor on Nearby Island (UCONI):

UCONI: "I've noticed a whole bunch of you Southeastern DX guys signing portable VP2K. What are you all doing there?"

N4NX: "Well, we thought we might enter the contest. Make a few contacts, you know . . ."

UCONI: "You guys know you don't have a chance, don't you? You're just DXers, and you're up against a finely-honed contest team here."

N4NX: "Well, yeah, you're probably right. We really don't have a lot of experience with this contest stuff. But since we're here, I guess we'll go ahead with it. You never know, we might get lucky."

UCONI: "There's not that much luck in the world! I've got $25 that says we beat you! How about it?"

N4NX: "$25? Well, hem . . . haw, I don't know. $25, you say? Hem . . . haw, do you really want to do that?"

UCONI: "Sure! That's right!! $25!!! How about it?"

N4NX: "Weeelll, I really can't do that, but I'll tell you what I will do. How about $100?"

UCONI: "Uhh, umm, ahh, OK then. (This shoe tastes awful.) You're on. $100 it is . . ."

N4NX: "Right, very good. Any witnesses on frequency?"

Tremendous pileup: "Yeah, I did . . . Me, too . . . Got it all on tape . . . every word . . . hook, line, and sinker . . ."

N4NX: "Well, nice talking to you. Good luck in the contest. QRZ from N4NX/VP2K . . ."

View from the 20-meter tower, looking over the 10- and 15-meter beams and three of the 75-meter verticals on the golf course. (Photo by K4PHE)

Anyway, by then it was time to leave for Kit's and the final pre-contest briefing. So we piled into the rented cars and headed for VP2KC on the other side of the island. A full day on the island must have jaded me a bit, because the first thing that struck me about Kit's estate was not the beauty, but the antennas. Besides the 160-meter vertical and the five-element 75-meter array, there were four other towers. One supported a two-element Telrex on 40 meters, another a five-element Telrex on 20, the third a three-element Telrex on 15, and the fourth a three-element Telrex on 10 meters. The element spacing on the 15-meter antenna was a bit wide because it used to be a 20-meter array before N4PN tuned it with a hacksaw. Hacksaw adjustments to Telrex antennas indicate that the adjustor is either very serious or very weak under the rafters. What kind of people was I hooked with here?

When we made the final head count, there were 21 operators. There had been a couple of last-minute cancellations, and we lost a few more to Prinair. About five people were stranded due to the grounding. Three made it as far as the Virgin Islands, where they operated from KP2A. This put something of a crimp into the operator scheduling plan, but no real problem, as Prinair was fond of telling us. The original operator schedule had each operator scheduled to do a specific task (operate, log, or spot) at a specific station during a specific time period. Rest periods were scheduled as well. W4HR had worked it all out on his computer, considering both the operators' stated preference and their known operating skills. There was no computer to redo it, so there was a manual revision—everyone was assigned an initial position, with instructions to continue as long as they were able.

About an hour before contest time, everyone made one last equipment check and made sure they were thoroughly familiar with everything. And everything was ready to go—right on down to sharp pencils and scratch pads. Each station even had a booklet of schedule info for the rare and semi-rare ones. The booklet was organized by schedule time and included the station's call, schedule frequency, and even the beam heading. With organization like that, how could we miss? The pre-contest pileup built. I was on 10 meters and the JAs were rolling in. From Asia, the Caribbean in general is considered good DX, and VP2K especially so. Extensive publicity in the JA DX press helped us immeasurably. By 0000Z, it sounded like half of Japan was on frequency.

This is a good time to tell you about Masa JA3ODC. All good things eventually come to the southeast, and Masa is no exception. He's a graduate student in Florida, and finding him was one of the best things that ever happened to us. He used to be a chief operator at the renowned contest station, JA3YKC, and judging from his performance at VP2KC, he learned his lessons very well. Most of the rest of us would be well pleased with a 250-per-hour QSO rate, but Masa at his peak was running 480! That's eight QSOs a minute! And since most of the QSOs were in Japanese, he had to log for himself, as the rest of us had a problem understanding who he was working. It wasn't long before he became known as "JA machine." Needless to say, his skills were very much in demand.

The rest of Asia must also have considered VP2K to be a good catch, if U0Y's reaction is any indicator. U0Y, as you may recall, is a Russian operation in that part of the Soviet Union that counts for Zone 23. I found them on 10 meters well past midnight. Ten was nearly dead, and I was making one last check before shutting down the station for the night. Naturally, I was pleased, since Zone 23 is usually difficult, especially on 10 meters. The QSO went something like this:

Me: "VP2KC."

U0Y: "AP2KC, you're 5923 (ho-hum)."

Me: "Thank you. You're 5908. Please correct the call. This is Victor Papa Two Kilo Charlie."

U0Y: "Oh! Oooh! Veeee

Light from the filaments of the 4CX5000s at peak of the contest. (Photo by WA4PBW)

P2KC! My dear friend, you are 5923. Where are your other stations? And what is QSL info, please, my very dear friend?"

I think we worked them on all bands except 160, and they reported that they heard us there, but couldn't work us.

I left the ten-meter station and wandered through the other stations. It was past sunrise in Europe, but the 75-meter station was still clicking off Europeans. And 15 was still wide open, with Masa working JAs at a tremendous pace. All the stations were manned, so I had a sandwich and a cold bottle of Carib, the local beer, and found a place to nap. Morning was there about three seconds after I closed my eyes.

W4HR and W4GIW were continuously monitoring progress versus the master plan and feeding it back to the stations. We always knew what we had to do to stay on track—work more 3-point QSOs, find more multipliers, switch to U.S. QSOs to pick up the QSO rate, or whatever. As with many things in life, the only sure road to success is to make a realistic plan and stay with the plan. All of the operators understood that, and to my knowledge, there were no serious episodes of "hot-dogging" or resistance to constructive criticism. The importance of proper planning, monitoring, and feedback can't be overemphasized.

One of the major events of the weekend for me was "The Arrival of the Luggage!" Whatever I was doing at the moment came to an immediate halt. In retrospect, I'm glad it wasn't in the middle of a QSO with Burma, because that

VP2KC
ST. KITTS W.I.
ST. KITTS W.I.
CONTEST TEAM

Kit VP2KC and his XYL, Annie Green, at the victory celebration. (Photo by WA4PBW) would have forced me into a very difficult decision. I must have luxuriated in that shower for a full fifteen minutes and spent the next fifteen minutes walking around with a silly grin, just thinking about how good it felt to be wearing my very own clean, comfortable clothes again. Even thinking about Prinair couldn't spoil the pleasure of the moment.

Much of the weekend sort of ran together, and I don't remember a lot of details with any clarity. I recall that Pat and some of the other wives came to visit and that we spent a few minutes sitting near the pool. I also remember operating, spotting, logging, eating, drinking, and napping, but nothing that really stands out until late Sunday morning. We had just finished changing shifts in the 10-meter station when W4HR came in to tell us that we were over the hump. According to preliminary count, we had nearly 30 million points and a new record. This didn't really come as a surprise, since we had been right on plan for hours and knew it was just a matter of time. Even so, those were welcome words. We had nearly nine hours to go, so even if the preliminary count was off, or if the dupe rate was exceptionally high, there was plenty of time. The rest of the contest was more like fun than work. We even stopped for about ten minutes in mid-afternoon so that all operators could get into the group pictures.

Almost all of our schedules were on the hour, so it seemed very unusual to find that we had a 10-meter schedule with FK8CR at exactly 2038Z. So, at exactly 2038Z, I swung the beam and tuned to the appointed frequency. Eddy was right there waiting to provide an extra multiplier. It turned out that it was already Monday in New Caledonia, and the 38 minutes was what Eddy needed to drive home from work on his break and warm up the radio. With cooperation like that, how can you lose?

It was over, and the champagne flowed. Some believed all along, others had their doubts, and for still others, the full impact hadn't dawned. After all, it isn't every day that we break world records. We were all dead tired, but not too tired for a victory dinner. So, off to the Ocean Terrace Inn to eat. Besides being tired, I had also had a bit too much bubbly, and so the only thing I recall about the meal was that it was delicious. On the other hand, considering the exhilaration of the moment, I probably would have remembered a meal of bread crusts and swamp water as delicious.

But, soon came the morning, sobriety, and another chance to deal with Prinair. Pat's schedule called for her to leave that day. Fortunately, Prinair was flying again. Also fortunately, Pat and I had each called Prinair at least once a day since we arrived, to reconfirm. If ever there were confirmed reservations, we had them. Still, we were uneasy and arrived at Golden Rock Airport well before flight time. Thankfully, everything went smoothly, and the flight departed with Pat aboard—only thirty minutes late, which was a superb performance.

Also on board was N4WW, in whose name the car was rented. So, off to Sunshine Car Rental, where it turned out to be a lot easier to simply say, "Dr. Regal requires his car for another day. I will pay you now." "Yes, sir, no problem," replied the clerk. By golly, the first "no problem" that really was no problem. Also no problem was getting a driver's license at the local police station. With only one day to go, I had seriously considered doing without the license, but then I considered the probable view from the St. Kitts jail. Thus, the trip to the police station for the license.

Time out for an official operators photo. Left to right, from top row down—W4GIW, VP2KC, K4PHE, W4PPT; WB4RUA, N4NX, K4UEE; K3OIH, W3BTX, N4PN; AA4V, W4LVM, N4WW; K4PI, K5PP, K1PBW (partially hidden); WA4PBW, N5UR; JA3ODC, N4RJ, WD4RCO, W4HR.

Back to VP2KC for the cleanup operation. The rest of the crew had been at work while I was at the airport with Pat, so there really was little left to do. As I mentioned earlier, the 75-meter vertical array had disappeared without a trace. The beams and the big 160 vertical stayed, so Kit still has a big signal on almost all bands.

That evening, there was a private cocktail party at the Fairview, but Fred Lam invited those of us who were still staying there to attend. We hadn't missed the Premier after all. Both he and the Governor General were there, as well as a large group of local dignitaries. They didn't really understand what a DX contest was, but they did understand what a world record was, and they were glad their little island had one. All in all, a very enjoyable evening.

Later on, W4PPT and I went to use the impromptu dipole to raise Atlanta so I could find out if Pat had arrived safely. Talk about bad conditions to the States! We tried and tried and tried with absolutely no results. The 3C0 operation was on at the time, and finally in desperation we called "CQ Atlanta" on the Annabon transmit frequency. A very long "CQ Atlanta." When not a single catcall or obscenity resulted, it was fairly clear we just weren't making the grade into the States. After a long while, and with a lot of help from a 6Y5, we finally got N4YD on frequency. Pat's trip was relatively uneventful, and she was safe and sound at home.

Next morning, most of the rest of us were scheduled to leave. At breakfast, we speculated what surprises Prinair might have for us that day and how to counter them. Nearly all of us arrived early at the airport to await the passenger list, telexed from San Juan. When it finally came, those of us who found our names breathed easier, and those who didn't went wild. There were pleas, threats, bribes, and a flurry of activity with the other airlines. In a way, I felt sorry for the agent, who had to make very careful decisions to ensure he would be alive to spend his bribes. After much anguish and lots of negotiation, all but two of us made it.

By this time, we were all familiar with "forgotten" luggage, so there was careful scrutiny of the procedures. Each of us made quite sure that we saw our personal luggage and equipment loaded. Only twenty minutes late (probably also a new world record), we were taxiing down the runway. The intercom was out of order, so the co-pilot shouted over the engine noise something about seat cushions for flotation, good luck, and banzai! I have the highest respect for the Prinair pilots. Anyone who can fly something with so many broken rivets and loose nuts has got to be good. Actually, the flight was smooth and uneventful, so the photographers among us amused themselves with shots of miscellaneous loose parts.

We arrived in San Juan, kissed the ground, and headed for customs to await the luggage. And did we ever wait and wait and wait. We knew it must be there, because we watched them put it on board. But being basically trusting souls, it never occurred to us that they might take it off at some intermediate stop. They did. No luggage again! Arrrrgh!! I couldn't believe it. Suffice it to say that my thoughts at that moment are entirely unprintable. Use your imagination.

Lunch that day is worth a comment. Throughout our stay on St. Kitts, the food was simply superb. Every meal was delicious, attractive to the eye, and served by people who obviously took pride in what they were doing. Even the sandwiches were great. Thinking about those delicately seasoned lobster sandwiches makes my mouth water. So, after all that, guess what we had as soon as we got back on U.S. soil? Almost without exception, we selected and eagerly devoured a greasy cheeseburger and equally greasy french fries. That must say something about the American palate.

Well, Eastern brought the luggage from St. Martin, Delta got us back to Atlanta, and so it ended. Long after I've forgotten how wretched Prinair is, I'll remember the beauty of St. Kitts and the friendliness of its people. I'll remember the hospitality of Kit Carson and his lovely wife. And I'll certainly remember how it feels to hold a world record. In a way, I hope someone breaks that record soon, because that will be the perfect reason to return to St. Kitts and do it all again.■

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Social Events

Listings in this column are provided free of charge on a space-available basis. The following information should be included in every announcement: sponsor, event, date, time, place, city, state, admission charge (if any), features, talk-in frequencies, and the name of whom to contact for further information. Announcements must be received two months prior to the month in which the event takes place. They should be sent directly to Editorial Offices, 73 Magazine, Pine Street, Peterborough NH 03458, Attn: Social Events.

YELLOWSTONE
AUG 1-3

The Wyoming-Idaho-Montana-Utah Amateur Radio Council will hold its Yellowstone National Amateur Radio Convention on August 1-3, 1980, at the convention center in West Yellowstone MT. The convention will feature a full program starting Friday morning and running through Sunday. Activities will include forums, contests, crafts, movies, swap tables, dealers, banquets, and much more. There are hotel-motel accommodations available adjoining the convention center and RV parks and campgrounds close by. There are airports and gas available in West Yellowstone. For more information, write WIMU, PO Box 20116, Salt Lake City UT 84120.

MACON MO
AUG 2

The Tri-County ARC, NEMO ARC, and Macon County ARC will hold the 2nd annual North Central Missouri Hamfest on Saturday, August 2, 1980, from 9:00 am to 5:00 pm at the Macon County Fairgrounds Park, Highway 63 south, Macon MO. There will be free parking, an enclosed area for commercial displays, food available on the grounds, and YL activities. Tailgaters are welcome. Tickets for the prize drawing will be available for $1.00 each at the door. The major prize will be either a color TV, an allband receiver, or a handheld two-meter transceiver. Talk-in on 146.52, 147.69/.09, and 146.07/.67. For more information, contact Charles Coy WB0ENV, 601 McKinley, Moberly MO 65270.

JACKSONVILLE FL
AUG 2-3

The Jacksonville Hamfest Association is pleased to announce that the 1980 Jacksonville Hamfest and ARRL Florida State Convention will be held on August 2-3, 1980, at a new location, the Orange Park Kennel Club at the intersection of I-295 and US Highway 17. Advance registration is $3.00 and is available from Jacksonville Hamfest, 1249 Cape Charles Avenue, Atlantic Beach FL 32233. Price at the door will be $3.50. A large indoor swap mart will be featured, with tables available at $5.00 per day. The table reservations can be ordered from Andy Burton WA4TUB, 5101 Younis Road, Jacksonville FL 32218. Interesting programs and forums are planned, as well as door prizes and many manufacturer and dealer exhibits. Plenty of family activities are available close by. The headquarters hotel is the Best Western located just across the street from the hamfest. Special rates of $23.00 single and $28.00 double are available; reservations should be made through the local number (904)-264-1211 to get the low rates. A special DXers' forum and dinner banquet will feature a Spratly Island presentation by Stu Woodward K4SMX. Also, Bill Barr N4NX will present a show on the VP2KC world record effort of over 32 million points in the CQ WW contest (1979). Reservations for the banquet can be obtained for $11.50 each by writing N4KE, 258 Wesley Road, Green Cove Spring FL 32043. For the fly-in ham, Herlong Airport is the closest landing site. Free weekend parking and rental automobiles are available. Phone (904)-783-2805 for more information. For more general information, write JHA, 911 Rio St. Johns Drive, Jacksonville FL 32211.

WARREN OH
AUG 2-3

A "DXpedition to the Center of the World" will be operated by the Warren Amateur Radio Association from 1300 GMT Saturday, August 2, 1980, to 2000 GMT Sunday, August 3, 1980. Frequencies will be 28.625, 21.360, 14.285, 7.235, and 3.900 MHz SSB. We will also monitor 21.125 for CW fans. QSL for a beautiful certificate with a large SASE (DX—2 IRCs) to W8VTD, Center of the World DXpedition, Box 809, Warren OH 44482.

ANGOLA IN
AUG 3

The Steuben County Radio Amateurs will hold their 22nd annual FM Picnic and Hamfest on Sunday, August 3, 1980, at Crooked Lake, Angola IN. Admission is $2.00. There will be prizes, picnic-style BBQ chicken, inside tables for vendors and exhibitors, and overnight camping (with a fee charged by the county park). Talk-in on 146.52 and 147.81/.21.

LEVELLAND TX
AUG 3

The Hockley County Amateur Radio Club and the Northwest Texas Emergency Net will sponsor their 15th annual picnic and swapfest on Sunday, August 3, 1980, beginning at 8:00 am at the city park in Levelland TX. This is an event for the entire family. A $3.00 registration fee is requested but not required. Lunch will begin at 12:30 pm with a bring-your-own-picnic-basket lunch. There will be swapping all day, with tables provided. Talk-in on 146.28/.88.

PITTSBURGH PA
AUG 3

The South Hills Brass Pounders and Modulators Radio Club will hold its 43rd annual hamfest on Sunday, August 3, 1980, on the south campus of the Community College of Allegheny County, located in West Mifflin Borough, just south of Pittsburgh PA. There will be ample indoor air-conditioned facilities on the ground floor with free table space. Electricity for equipment and/or displays will be available. There will be hard-surface parking available, food and refreshment at nominal cost, and airport and motel accommodations within a one-mile radius. For more information and pre-registration, write Bruce K. Banister WB3AKK, 5954 Leprechaun Dr., Bethel Park PA 15102, or phone (412)-833-3978.

PETOSKEY MI
AUG 9

The Straits Area Radio Club will hold its Swap and Shop on Saturday, August 9, 1980, from 9:00 am until 4:00 pm, at the 4-H Building, Emmet County Fairgrounds, Charlevoix Avenue (¼ mile west of the intersection of US 131 and 31), Petoskey MI. Free parking (Friday night for self-contained vehicles) and refreshments will be available. Features include a ladies' bus tour to Cross Village with Mort Neff as conductor, one main prize, and smaller prizes hourly. There will be a donation of $2.00 at the door. Table space is also $2.00. Talk-in on .52 and .07/.67.

BURLINGTON VT
AUG 9-10

The Burlington Amateur Radio Club will hold its annual International Hamfest on August 9-10, 1980, at the Old Lantern Campground, 14 miles south of Burlington VT. Admission is $4.00. Planned events include a flea market, commercial exhibitors, interesting and useful door prizes, and the traditional Can-Am tug-of-war. Talk-in on .34/.94. For more information, contact Hap Preston W1VSA, PO Box 312, Burlington VT 05402.

CEDARTOWN GA
AUG 10

The Cedar Valley Amateur Radio Club will hold its annual Cedar Valley Hamfest on August 10, 1980, from 8:00 am to 4:00 pm at the Polk County Fairgrounds, on US 278, two miles east of Cedartown GA. There will be food, drinks, and prizes. Talk-in on 147.72/.12 (WR4AZU). For more information, contact Jim T. Schliestett W4IMQ, Secretary, Cedar Valley ARC, PO Box 93, Cedartown GA 30125, or phone (404)-748-5968.

CONCORD NC
AUG 10

The Cabarrus Amateur Radio Society will hold its second annual hamfest on Sunday, August 10, 1980, at the Boys Club on Spring Street, Concord NC. Admission is $2.00, with children under 12 admitted free. There will be a covered flea market area, dealer displays and sales, door prizes, and YL activities. Flea market tables are $3.00 each, with setup time at 0700 EST Sunday morning. There will be hot coffee, hot dogs, homemade cakes, and ample parking. Major prizes include a TS-520SE and a TS-7600.

You do not have to be present to win 1st or 2nd prizes. Talk-in on 146.52 and 146.055/146.655 (club repeater K4CEB/R). For more details, contact Jim Austin, PO Box 1290, Concord NC 28025.

ST. CLOUD MN

AUG 10

The St. Cloud Radio Club will hold its annual hamfest on August 10, 1980, at the Whitney Park Senior Center from 9:00 am until 5:00 pm. There will be free overnight camping available one mile from the site at the Sauk Rapids Lions Park. Food will be available and Uncle Tom's (W0CF) chili will be featured. There will be a swapfest and prizes. For more information, write William (Bill) R. Zins WA0OTO, RR 4, St. Cloud MN 56301 or phone (612)-253-3428.

LEXINGTON KY

AUG 10

The Bluegrass Amateur Radio Society will hold its annual ARRL Central Kentucky Bluegrass Hamfest on August 10, 1980, starting at 8:00 am at the Fasig-Tipton Sales Paddock, Newton Pike, Lexington KY. Admission is $3.00 in advance and $3.50 at the gate. This fee includes parking. There will be grand prizes, hourly door prizes, indoor exhibits and distributors, a paved outside flea market, and food service will be available. Talk-in on 146.16/.76. For details, write Bluegrass Hamfest, Attention: Edward Bono WA4ONE, 2077 Dogwood Drive, Lexington KY 40504.

NEW KNOXVILLE OH

AUG 10-16

The Way International will hold its annual Rock of Ages Festival on August 10-16, 1980, in New Knoxville OH. K8MP/8 will operate from this Christian music festival on 3.930, 7.230, 14.330, and 146.52. Commemorative "ROA 1980" QSLs will be sent to those stations worked.

WILLOW SPRINGS IL

AUG 10

The Hamfesters Amateur Radio Club will hold its 46th annual hamfest on Sunday, August 10th, 1980, at Santa Fe Park, 91st and Willow Springs Road, Willow Springs IL (near Chicago). Gates will open at 6:00 am. Tickets at the gate are $3.00 each or $2.00 each in advance. There will be free coffee for the early birds, games for the kids, prizes for the YLs, and the world-famous shoppers' row. Children under fifteen are free. For more information and advance tickets, send an SASE and a check to Hamfesters Amateur Radio Club, PO Box 42792, Chicago IL 60642.

OAKLAND NJ

AUG 16

The Ramapo Mountain Amateur Radio Club will hold its annual flea market on Saturday, August 16, 1980, at the American Legion Hall, Oak Street, Oakland NJ. Indoor tables are $5.00 and tailgating is $3.00. There is no admission fee for buyers. Refreshments will be available on the premises. Talk-in on 147.49/146.49 WR2AHD or 146.52 simplex. For advance reservations and information, call Bud Hauser WA2JUO at (201)-797-8471 or (201)-791-0589.

FARMINGTON ME

AUG 16-17

The Sandy River Amateur Radio Club will hold a hamfest/flea market on Saturday and Sunday, August 16-17, 1980, at the Farmington Fairgrounds, Farmington ME. Admission is $1.00, with no charge for tailgating. Commercial dealers are welcome. Door prizes will be awarded both days and on Sunday there will be a raffle at 1:00 pm. Features include free camping from 5:00 pm Friday until Sunday afternoon and refreshments and snacks both days (with a lobster or chicken dinner served late Saturday afternoon). Talk-in on 146.37/.97 and 146.52. For more information and a map, send an SASE to Charles Stenger W1HTG, Box 111, East Dixfield ME 04227.

FT BRAGG NC

AUG 16-17

The Cape Fear Amateur Radio Society's 4th annual hamfest will be held on August 16-17, 1980, at the Main Officers' Club, Ft. Bragg NC. Tickets are $1.00 in advance and $2.00 at the door. There will be 9,000 square feet of air conditioned space available. Prizes will include a TS-120S, a triband beam, a handie-talkie, and a rotor. There will be a Saturday night social and a QCWA luncheon meeting on Sunday. Talk-in on 146.31/.91, 147.93/.33, and 146.52. Send an SASE to Marie Presler WA4YMM, PO Box 35171, Fayetteville NC 28303, for tickets.

NORTH HAVEN CT

AUG 16-17

The South Central Connecticut Amateur Radio Association will hold its Super Scarafest '80 on August 16-17, 1980, at the Ramada Inn, at Exit 12 of I-91, North Haven CT 06473. Booths will be available. Features will include a ham and computer flea market, an auction, special events for non-ham spouses and children, and drawings for prizes throughout the show. Prizes will include a solid-state low-band transceiver, a synthesized two-meter HT, a microcomputer, and a 600-MHz frequency counter. Admission will be $4.00, pre-registration before July 1, and $5.00 at the door for both days. Talk-in on 146.01/146.61. For further information, write Super Scarafest '80, PO Box 5265, Hamden CT 06518, or call Jeff Wayne K1YLV at (203)-281-6038 between 9:00 am and 9:00 pm EST.

BEAR DE

AUG 17

The Fifth Annual New Delmarva Hamfest will be held on Sunday, August 17, 1980, at Gloryland Park, Bear DE. Admission will be $2.00 in advance and $2.50 at the gate. Tailgating will be $2.50 and tables under the pavilion, $4.00. Prizes, food and drinks will be available. Talk-in on .52 and .13/.73. For more information, send an SASE to Stephen Momot K3HBP, 14 Balsam Road, Wilmington DE 19804. Make checks payable to Delmarva Hamfest, Inc.

HUNTSVILLE AL

AUG 17

The North Alabama Hamfest will be held on Sunday, August 17, 1980, at the Von Braun Civic Center in Huntsville AL. Admission is free. There will be prizes, exhibits, forums, an air-conditioned indoor flea market, and ladies' activities. Tours of the Alabama Space and Rocket Center are available for the family. A hamfest supper will be held on Saturday night. A limited number of camping sites with hookups are available at the VBCC on a first-come-first-served basis. Flea market tables are available for $3.00. Talk-in on 3.965 and .34/.94. For more information, write NAHA, PO Box 423, Huntsville AL 35804.

LAFAYETTE IN

AUG 17

The Tippecanoe Amateur Radio Association, Inc., will hold its 10th annual Lafayette, Indiana, Hamfest on Sunday, August 17, 1980, rain or shine, at the Tippecanoe County Fairgrounds, 18th Street at Teal Road (Indiana Highway 25), Lafayette IN. There is no extra charge for flea-market setups and they can be made any time after 1800 hours on Saturday. Advance tickets are available by mail at $2.50 per ticket. Send payment and an SASE by the 10th of August to J. B. Van Sickle K9KRE, RR1, Box 63, West Point IN 47992. Tickets are also available at the gate. Pre-registration and grand prizes will be ICOM IC-2A synthesized 2m hand-helds with tone pads and chargers. Many other prizes will be awarded throughout the day. There will be forums, on-the-grounds parking, and food and drinks available at reasonable prices, as well as overnight camping on the grounds Saturday night. Talk-in on 146.13/.73 and 146.94. The call-in station is W9REG.

MONTGOMERYVILLE PA

AUG 17

The Mid-Atlantic Amateur Radio Club will hold its annual J.B.M. Hamfest on Sunday, August 17, 1980, from 9:00 am to 4:00 pm, rain or shine, at the Route 309 Drive-in Theatre, ¼ mile north of Rte. 63, Montgomeryville PA (6 miles north of the Fort Washington interchange of the Pennsylvania Turnpike). Admission is $2.50 with $1.00 additional for the first tailgate space and 75¢ for each additional tailgate space. Tailgate setup begins at 8:00 am. Features will include refreshments, raffles, door prizes, and a sanctioned transmitter hunt by the Freedom Foxhunters Association. Talk-in on 147.66/.06 (WB3JOE) or 146.52. For further information, call Don Schuenemann WB3AYT at (215)-822-9076, or write the Mid-Atlantic Radio Club (MARC), Box 14429, Philadelphia PA 19115.

REND LAKE IL

AUG 17

The Shawnee Amateur Radio

Association Hamfest will be held on August 17, 1980, at the North Marcum access area on Rend Lake in southern Illinois. Complete recreational facilities, including beach and campsites, will be available. Talk-in on 146.25/.85, 146.52, and 3.925.

WARREN OH
AUG 17

The Warren Amateur Radio Association will hold its 23rd hamfest on August 17, 1980, at Trumbull Branch, Kent State University. There will be five acres of flea market, tech forums, DX programs, inside dealer displays, and XYL activities. For further information, QSL to WARA, PO Box 809, Warren OH 44482.

TACOMA WA
AUG 23-24

The Radio Club of Tacoma (W7DK) will hold its annual Hamfair on August 23-24, 1980, at the campus of Pacific Lutheran University, 122nd and Park Avenue. Registration is $4.00 and the banquet is $6.00. Events include a flea market, door prizes, commercial displays, a banquet, a loggers' breakfast, seminars, and much more. Talk-in on .88/.28. For additional information, contact Joe Winter WA7RWK, 819 No. Mullen, Tacoma WA 98406 or phone (206)-759-9857.

BLUEFIELD WV
AUG 24

The East River Amateur Radio Club, Inc., will sponsor Bluefield Hamfest '80 on Sunday, August 24, 1980, from 9:00 am to 4:00 pm, at the Bluefield Armory-Civic Center, one mile north of Bluefield WV on US 52. Admission, which includes a prize ticket, is $2.00 in advance and $3.00 at the gate. Children under 12 will be admitted free. Prizes include a Ten-Tec Argonaut 80-10m QRP transceiver, an 80-10m trap vertical antenna, a Cushcraft 11-element 2m beam, and more. Tables are $5.00, or $4.00 each for 3 or more, and tailgaters are $2.00. There will be something for the entire family. Food, dealers, a flea market, forums, demonstrations, and entertainment will be available. Talk-in on .89/.49 and .52/.52. For more information, send an SASE to Bluefield Hamfest '80, 2113 Hemlock Hill, Bluefield WV 24701.

LA PORTE IN
AUG 24

The annual LaPorte County Hamfest will be held, rain or shine, on Sunday, August 24, 1980, at the County Fairgrounds on Highway 2, west of LaPorte IN (50 miles SE of Chicago). There will be an outdoor paved flea market area, indoor tables at $1.00 each, and overnight trailer hookups available on site for early birds. Advance tickets are $2.00. For reservation or information, send an SASE to PO Box 30, LaPorte IN 46350.

MARYSVILLE OH
AUG 24

The Union County Amateur Radio Club will hold its fourth annual Hamfest-80 on Sunday, August 24, 1980, at the fairgrounds in Marysville OH. There will be a free gate until 10:00 pm Saturday; then admission is $2.00 each or $1.50 in advance. Features will include free overnight camping, free movies Saturday night, breakfast served all night until 10:00 am Sunday, many prizes, including a Kenwood TR-2400, a flea market, ARRL forums, and MARS and FM meetings. For more information or advance tickets, write UCARC, 13613 US 36, Marysville OH 43040, or phone (513)-644-0468.

ST. CHARLES IL
AUG 24

The Fox River Radio League will hold its annual hamfest on Sunday, August 24, 1980, from 8:00 am to 4:00 pm at the Kane County Fairgrounds, St. Charles IL. There will be a free outside flea market and a large inside display area. Table discounts are available for prepaid registration. Contact Gary Senesac KA9ADP, 926 Britta Lane, Batavia IL 60510, for details. Refreshments and a hot lunch will be available. Talk-in on 146.94. Tickets are $1.50 in advance and $2.00 at the gate. Contact Jerry Frieders W9ZGP, 1501 Molitor Road, Aurora IL 60505.

SEWELL NJ
AUG 24

The Gloucester County ARC will hold its second annual hamfest on Sunday, August 24, 1980, from 8:00 am to 3:00 pm at Gloucester County College, Tanyard Road, Sewell NJ. Tickets are $2.00 in advance, $2.50 at the door, and dealers' and tailgaters' admission is $5.00. Tailgaters can set up at 7:00 am and indoor and outdoor spaces will be available. There will be food and prizes. Talk-in on .52 and .78/.18. For information and tickets, contact Bob Grimmer KN2QWO, 229 William Avenue, Barrington NJ 08007.

WATERLOO IA
AUG 24

The Iowa 75 Meter Net will hold its annual swap meet and picnic on Sunday, August 24, 1980, at Hickory Hills Park, south of Waterloo IA. A potluck meal will start at noon and a program will follow (with prizes). For further information, contact Lovelle J. Pedersen WB0JFF, Net Secretary, 2327 W. Reinbeck Rd., Hudson IA 50643.

WENTZVILLE MO
AUG 24

The Saint Charles Amateur Radio Club will hold Hamfest '80 on August 24, 1980, at the Wentzville Community Center, Wentzville MO. Featured will be a flea market with free space, prizes, equipment displays, grab bags, a cake walk, free bingo, and refreshments. Free doughnuts and coffee will be available to the early birds. Talk-in on .07/.67 and .34/.94. For information on motels, tickets, displays, prize lists, camping, etc., contact Jim Short AG0U, Rt. 1, Box 40, O'Fallon MO 63366.

MT PLEASANT IA
AUG 28-SEP 1

The Mt. Pleasant, Iowa, Amateur Radio Club invites hams attending the Midwest Old Threshers Reunion in Mt. Pleasant from August 28-September 1, 1980, to stop by and register in the guest book at the ham shack. Last year nearly a quarter of a million people attended this show of antique steam engines and first-rate entertainment, and 150 hams visited the ham shack. The club provides communications for crowd control with talk-in on the 147.99/.39 Mt. Pleasant repeater and 146.52 simplex. A station will also be operating on 3970 kHz with the call W0MME. There is a special QSL card to commemorate the event. For more information, write Dave Schneider WD0ENR, 507 Vine, Mt. Pleasant IA 52641.

SYDNEY NS
AUG 29-SEP 1

The Sydney Amateur Radio Club will host the 1980 Maritime Convention, Ham Ceilidh 80, on Labor Day weekend, August 29 —September 1, 1980, at the Isle Royale Hotel, Sydney, Cape Breton Island, Nova Scotia, Canada. There will be plenty of free parking and shopping for the ladies. The program will include many items of interest and will cater to amateurs along with their XYLs. Friday evening, August 29, will be a special event with registration and a ham get-together. For more information, contact the Sydney Amateur Radio Club, Box 1051, Sydney, Cape Breton, Nova Scotia CAN B1P 6J7.

GEORGETOWN IL
AUG 30-31

The Illiana Repeater System, Inc., amateur radio club will hold its 11th annual Danville, Illinois, Hamfest, Saturday and Sunday, August 30-31, 1980, at the Georgetown, Illinois, Fairgrounds. Advance gate donations are $1.50 per adult; $2.00 at the gate, with children 14 years and younger free. Activities will include two days of flea markets, commercial exhibitors, RTTY setups, an Antique Wireless Association display, a home-brew builders contest, a USAF MARS station, and other interests. Meals and refreshments will be served both days and overnight camping facilities are available. For more information or advance tickets, send an SASE to Illiana Repeater System, Inc., PO Box G, Catlin IL 61817.

MARSHALL MI
AUG 31

On Sunday, August 31, 1980, from 8:00 am to 5:00 pm, "Historic Marshall's" 72/12 E. S. Team will hold its Trunk 'n Trailer Bash on the whole block of 615 S. Marshall Avenue, Marshall MI (1830 site of Michigan's capitol and governor's mansion). The donation is $2.00, spaces are $5.00, and inside space is 50 cents a foot. There will be free parking and a huge consignment area for the mini-swapper. For further information, send an SASE to K8UCQ, 110 Perrett, Marshall MI 49068.

NASHVILLE TN
AUG 31

The 31/91 Short Mountain Repeater Club will sponsor the annual Cedars of Lebanon Hamfest and Family Picnic on the last Sunday in August. Prizes, swimming, horseback riding, and other sports will be available. Everyone is welcome. For more information, contact John Fite W4PFP, Watertown TN; phone: (615)-237-3621.

PECATONICA IL
AUG 31

The third annual Rockford Hamfest and Illinois State ARRL Convention will be held at the grand exhibition hall at the Winnebago County Fairgrounds at Pecatonica, just west of Rockford on US Route 20. Tickets are $2.00 in advance or $2.50 at the gate and are available from any RARA member. They may also be obtained by mail by writing to RARA, PO Box 1744, Rockford IL 61110 and including a business-size SASE. Food and campsites (with electric and sanitary hookups) will be available, as well as plenty of free parking. For flea market dealers, there will be 300 tables available at a nominal charge. There will be speakers and forums, demonstrations and discussions, and prizes. Talk-in on 146.01/.61 Rockford repeater, or 146.52.

PENSACOLA FL
AUG 31

The Five Flags Amateur Radio Association, Inc., will hold its 1980 Ham-A-Rama on August 31, 1980, from 8:00 am to 4:00 pm at the Pensacola Municipal Auditorium, Pensacola FL. Admission will be $1.00 and swap tables will be available for $5.00 each. Additional information can be obtained by writing to the FFARA, PO Box 17343, Pensacola FL 32522.

AUGUSTA NJ
SEP 6

The Sussex County Amateur Radio Club will hold its second annual hamfest on Saturday, September 6, 1980, at the Sussex County Farm and Horse Show grounds, Plains Road off Route 206, Augusta NJ. Admission for sellers at the outside flea market is $5.00 at the door and $4.00 in advance. Admission for indoor sellers is $6.00 at the door and $5.00 in advance. Admission for buyers is free and a door prize ticket is $1.00. Talk-in on 147.90/.30 and 146.52. For pre-registration and information, write Sussex County Amateur Radio Club, PO Box 11, Newton NJ 07860, or call Ed Woznicki AC2A at (201)-852-3268.

GRAYSLAKE IL
SEP 6-7

The Chicago FM Club will hold Radio Expo '80 on September 6-7, 1980, at the Lake County Fairgrounds, Rtes. 45 and 120, Grayslake IL from 9:00 am to 4:00 pm both days. The flea market is open from 6:00 am to 6:00 pm. Tickets, good for both days, are $2.00 each before September 1st and $3.00 at the gate. Indoor flea market space is free with an admission ticket on a first-come basis. Bring your own table and chair. Outside are many acres of available space. Features will include commercial exhibitors in ham radio and computers, ladies' programs, hourly door prizes with a super drawing at 3:00 pm on Sunday with prizes worth thousands of dollars. Food, nearby hotels, free parking, and camping with some hookups will be available. Talk-in on 146.16/.76 or 222.50/224.10 WA9ORC. For advanced tickets, send an SASE to Radio Expo Ticket, PO Box 1532, Evanston IL 60204. For more information, call (312)-BST-EXPO.

MELBOURNE FL
SEP 6-7

The Platinum Coast Amateur Radio Society will hold its 15th annual hamfest and indoor swap-and-shop flea market on September 6-7, 1980, at the Melbourne Civic Auditorium. Admission is $3.00 in advance and $4.00 at the door. Swap tables are $5.00 per day. There will be food and plenty of free parking available, as well as awards, forums, and meetings. Talk-in on .25/.85 and .52/.52. For reservations, tables, and information, write PCARS, PO Box 1004, Melbourne FL 32901.

FINDLAY OH
SEP 7

The Findlay Radio Club will hold its 38th annual Findlay Hamfest on Sunday, September 7, 1980 (*not* September 27, as previously published), at a new location, the Hancock Recreational Center, just east of I-75 exit 161, on the north edge of Findlay, 40 miles south of Toledo. Tickets are $2.00 in advance and $2.50 at the door. Reserved tables are $2.50 per half. There will be forums on Saturday evening and setup Sunday at 5:00 am. Main prizes are a TS-120S with supplies, two TR-2400s, and an AT-120 matcher. For tickets, information, and reservations, send an SASE to PO Box 587, Findlay OH 45840.

PENNSAUKEN NJ
SEP 7

The South Jersey Radio Association will hold its 32nd annual hamfest on Sunday, September 7, 1980, on the grounds of the Pennsauken Senior High School, Hylton Road (1½ miles SE on Rte. 73 from the Tacony Palmyra Bridge), Pennsauken NJ. Admission is $3.00 and tailgate or booth space is $5.00 per seller. Features wil include a flea market, prize drawings, contests, bingo for the ladies, and games for the children. Talk-in on 146.52 or 146.22/.82. For more information, contact Edwin T. Kephart W2SPV, Hamfest Chairman, 4309 Willis Avenue, Pennsauken NJ 08109.

PORT JEFFERSON NY
SEP 7

The Suffolk County Radio Club will hold its third annual Electronic Flea Market on September 7, 1980, with a rain date of September 14, 1980. The site is the Odd Fellows Hall, Jane Boulevard, Port Jefferson LI NY. Walk-ins will be $1.50 and sellers will be $3.00. Gates will open at 7:00 am. Bargains, prizes, food, and friendship will be available. Talk-in on .52, .94, and 223.50. For further information, contact Floyd Davis WA2SDI at (516)-234-9376.

SOUTH DARTMOUTH MA
SEP 7

The South Eastern Massachusetts Amateur Radio Association will hold its annual picnic and flea market on Sunday, September 7, 1980, from 9:00 am until 4:00 pm at the Stackhouse Fairgrounds, Faith Street, South Dartmouth MA. The rain date will be September 14, 1980. Sales space is $6.00 and tables for rent are $4.00. There will be free parking, entertainment, and food and beverages for sale. Talk-in on 147.60/147.00 or CB channel 11. For information, write SEMARA, PO Box P-105, South Dartmouth MA 02748, or phone (617)-997-3674 or (617)-994-4838.

HAMBURG NY
SEP 12-13

The 9th annual Ham-O-Rama '80 hamfest will be held on September 12-13, 1980, at the Erie County Fairgrounds. Advance tickets are $3.00. There will be exhibits, tech programs, prizes, flea markets, plenty of free parking, and free RV hookups. For more information and tickets, contact Ron Brodowski KC2P, 260 Hilltop Drive, Elma NY 14059, or phone (716)-652-6754.

VALPARAISO IN
SEP 14

The Porter County Amateur Radio Club, Inc., will hold its annual hamfest on September 14, 1980, at the Porter County Fairgrounds, Valparaiso IN. Featured will be a flea market, technical sessions, door prizes, and bingo. Food will be available. Advance tickets are $1.50 and tickets at the gate are $2.00. There will be dealers and commercial exhibitors, as well as free indoor and outdoor space. Gates will open at 6:00 am. Talk-in on 147.96/.36 and 146.52. For tickets and information, write Charles Baker W9SJN, PO Box 251, Portage IN 46368.

WHITESTONE NY
SEP 18

The Tu-Boro ARC will hold its annual auction on September 18, 1980, at the Odd Fellows Hall, 149-14 14th Avenue, Whitestone NY. Doors will open at 6:00 pm for sellers and at 7:00 pm for buyers. Donation is $1.00 per person. Beer and soda will be available. Talk-in on 146.52. For information, call Walt WB2PFO at (212)-539-5732 nights, and Ed WB2IBQ at (212)-746-4082.

TYSONS CORNER VA
SEP 27-28

The National Capitol DX Association will sponsor DXPO 80 on Saturday and Sunday, September 27-28, 1980, at the Ramada Inn, junction of Rte. 7 and I-495, Tysons Corner VA. Saturday's half-day session will include Phase I of the DXPO Program, an Attitude Adjustment Party, and a banquet with prizes and surprises. Sunday's session will feature Phase II of the DXPO Program. Unless you have previously attended DXPO, write to Dick Vincent K3AO, Rte. 1, Box 230, Bryantown MD 20617, for more information. If you have any program suggestions, contact John Boyd W4WG, 8424 Reflection Lane, Vienna VA 22180.

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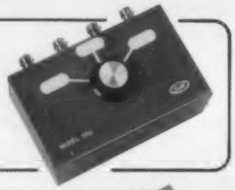

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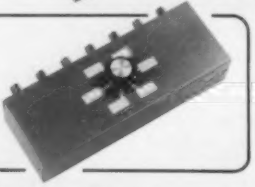

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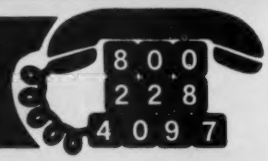

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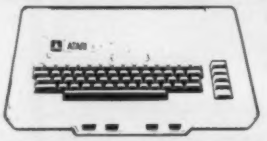

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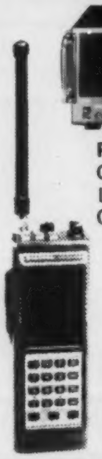

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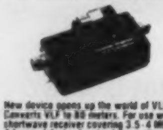

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100 watts	100H	100A	100C	100D	100E
250 watts	250H	250A	250C	250D	250E
500 watts	500H	500A	500C	500D	500E
1000 watts	1000H	1000A	1000C	1000D	1000E
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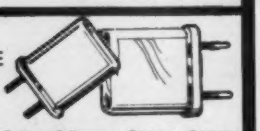

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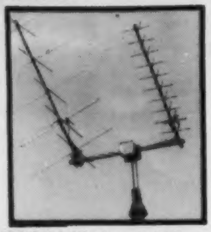
OSCAR



OSCAR Satellite Communications

Cushcraft offers complete antenna systems for OSCAR satellite communications on 2m and 70 cm. On 145 MHz the 10-element twist antenna (5 vertical elements, 5 horizontal) yields up to 10.8 dBd gain; the 20-element 435 MHz twist (10 vertical elements plus 10 horizontal) provides up to 13.6 dBd gain. For greater performance on 2m choose the 20-element 145 MHz twist which offers 13.6 dBd gain. The half-power beamwidth of these antennas has been optimized for reliable satellite communications with minimum tracking requirements. All twist antennas come complete with coaxial matching harness for selectable horizontal, vertical, or circular polarization. Match 50-ohm feedlines.

ATV-5

ATV-5

This trapped vertical antenna system has been engineered for five-band operation on 80m-10m. The high Q traps are carefully optimized for wide operating bandwidth. 2:1 SWR bandwidth with 50-ohm feedline is approximately 1 MHz on 10m, more than 500 kHz on 15m and 20m; 160 kHz on 40m; and 75 kHz on 80m. Instructions are provided for adjusting resonance to your preferred part of the band, CW or SSB. Built-in coaxial connector takes PL-259. Nominal height, 293 inches. Rated at 2000 watts PEP on all bands.

Two Meter Boomers

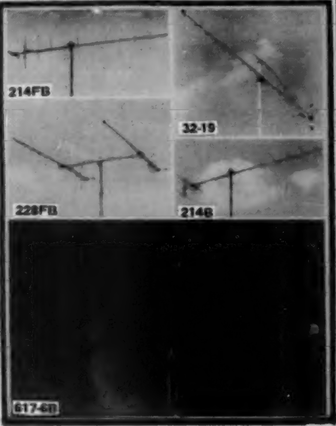
Whether you have the space for the 3.2 λ 32-19 or the compact 2.2 λ models, 2m Boomers are your best choice. They offer the maximum gain available for their boom length (See NBS no. 688). They feature triple reflectors for additional front-to-back ratio and cleaner patterns. All stainless steel hardware and heavy gauge heat treated aluminum are used throughout. Whatever your choice of 2m activity, the Boomer will fill your needs. For FM use the 228FB or 214FB. For CW/SSB on the low end use 32-19 or 214B, or EME, DX or just reliable QSOs, Boomer will perform for you.

Six Meter Boomers

The new 6m Yagi offers more boom, more gain and fewer elements. Designed for the low end of the band, the 6m Boomer has Cushcraft's typical attention to detail, the Boomer's balanced feed with balun, and extra heavy duty mechanical construction. The secret behind its super performance and light weight is special element spacing and boom lengths.

Specifications

Model number	32-19	214B	214FB	228FB	617-6B
Frequency range (MHz)	144-146	144-146	144.5-148	144.5-148	50.0-51
Forward gain (dBd)	16.2	15.2	15.2	18.2	14
Front to back ratio (dB)	20	20	20	24	30
E-plane beamwidth (deg)	2x14	2x17	2x17	2x17	2x19
H-plane beamwidth (deg)	2x17	2x18	2x18	[illegible]	NA
Side lobe attenuation (dB)	-60	-60	-60	-60	-60
SWR less than (typ)	1.2:1	1.2:1	1.2:1	1.2:1	1.2:1
Impedance (ohm)	50	50	50	50	50
Recommended stacking distance E-plane (ft)	14	10	10	10	NA
H-plane (ft)	12	10	10	10	22.5
Weight (lbs)	12	8	8	22	28
Length (ft)	22	15	15	15	39
Longest element (in)	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Turning radius (ft)	11	7.5	7.5	9.5	12.0
Windload (sq ft)	3.5	1.7	1.7	4.0	4.8



ALL PRICES SHOWN ARE LIST PRICES!
CALL FOR SPECIAL PACKAGE PRICING!

Skywalker

Skywalker

3 and 4 Element Single Band Yagis

Skywalker

More contacts, less waiting, less interference, and a better signal at the other end are yours with the Skywalker series of single band Yagis. The 10dBd forward gain of the 4 element models will put you first in line. See the chart for all the details.

Heavy wall heat treated 6063 T832 aluminum tubing, ruggedly plated steel fasteners, and carefully formed aluminum brackets. Assembly is simple with the new Cushcraft Beam Assembly Marking System.

Specifications

Model number	20-4CD	20-3CD	15-4CD	15-3CD	10-4CD	10-3CD
Frequency range (MHz)	14.0-14.35	14.0-14.35	21.0-21.45	21.0-21.45	28.0-29.7	28.0-29.7
Forward gain (dBd)	10.0	8.0	10.0	8.0	10.0	8.0
Front to back ratio (dB)	30	30	30	30	30	30
Boom length (ft)	32	18	20	14	17	12
Longest element (ft-in)	35-10	35-8	23-4	23-2	17-10	17-8
E-plane Breadth (deg)	60	56	57	56	57	56
Side lobe attenuation (dB)	>40	>40	>40	>40	>40	>40
SWR less than (typ)	1.2	1.2	1.2	1.2	1.2	1.2
Recommended stacking distance H-plane (ft)	44	40	33	30½	22	21
Turning radius (ft-in)	20	23	15-4	13-6	14	10
Weight (lbs)	55	30	25	20	18	11
Windload (sq ft)	8.1	5.5	4.5	3.4	3.1	2.3

ATB-34

ATB-34

ATB-34 — 10-15-20 Meters

The Cushcraft ATB-34® 3-band antenna offers the no-compromise performance of a single-band Yagi on 10m, 15m, and 20m, and represents the best in state-of-the-art antenna design. The antenna's rugged construction, broad bandwidth, and four active elements give superb performance. Quality workmanship and the use of the best available materials give an estimated wind survival rating of 80 mph. Forward gain is 7.5 dBd on all bands; front-to-back ratio is nominally 30 dB on 20m; 22 dB on 15m; and 18 dB on 10m. Nominal input impedence is 50 ohms; VSWR is 1.5:1 or less at resonance.

PRICE LIST

LAST CHANCE FOR OLD PRICES!

MODEL	DESCRIPTION	LIST PRICE
BOOMER ANTENNAS		
32-19	144-148 MHz, 19 element, 3.2 λ	[illegible]
214B	144-148 MHz, 14 element, 2.2 λ	[illegible]
214FB	144.5-148 MHz, 14 element, 2.2 λ	[illegible]
228FB	144.5-148 MHz, 28 element, 2.2 λ	218.95
617-6B	50-51 MHz, 6 element, 1.7 λ	199.95
BOOMER STACKING KITS		
32-SK	Stacking Harness & P.D., 2 Boomers	39.95
324-QK	Quad Stacking Kit, 4 Boomers	289.95
22-SK	Stacking Harness & P.D., 2 Jr. Boomers	36.95
224-QK	Quad Stacking Kit, 4 Jr. Boomers	249.95
228-VPK	Vert. Pol. Kit, 2 FM Boomers	89.95
PD-2	Power Divider, 2 Boomers	19.95
PD-4	Power Divider, 4 Boomers	[illegible]
MULTIBAND HF ANTENNAS		
ATB-34	Three Band 4 element Beam	[illegible]
ATV-3	Three Band Trapped Vertical	[illegible]
ATV-4	Four Band Trapped [illegible]	[illegible]
ATV-5	Five Band T[illegible]	[illegible]
SKYWALKER BEAMS		
20-4 CD	[illegible]	[illegible]
20-3 CD	[illegible]	[illegible]
15-4 CD	21 [illegible] 4	[illegible]
15-3 CD	21 MHz, [illegible] A21-3	[illegible]
10-4 CD	[illegible] 4 element, A28-4	[illegible]
10-3 CD	[illegible], 3 element, A28-3	[illegible]
MOBILE ANTENNAS		
AMS-147	146-148 MHz, Stainless Magnet Mt.	28.95
ATS-147	146-148 MHz, Stainless Trunk Mt.	28.95
AMS-220	220-225 MHz, Stainless Magnet Mt.	28.95
ATS-220	220-225 MHz, Stainless Trunk Mt.	[illegible]
FM ANTENNAS		
A147-4	146-148 MHz, 4 el[illegible]	[illegible]
A147-11	146-148 MHz, 11 [illegible]	[illegible]
A147-20T	146 & 147 MHz, 2[illegible]	[illegible]
A147-22	146-148 MHz, 22 e[illegible]	[illegible]
A220-7	220-225 MHz, 7 ele[illegible]	29.95
A220-11	220-225 MHz, 11 ele[illegible]	37.95
A449-6	440 MHz, 6 element	26.95
A449-11	440 MHz, 11 element	37.95
AFM-4D	144-148 MHz, Four Pole	68.95
AFM-24D	220-225 MHz, Four Pole	64.95
AFM-44D	440-450 MHz, Four Pole	59.95
AR-2	135-170 MHz, Ringo	24.95
AR-6	50-54 MHz, Ringo	29.95
AR-220	220-225 MHz, Ringo	24.95
AR-450	440-460 MHz, Ringo	24.95
ARX-2	135-170 MHz, Ringo Ranger	39.95
ARX-2K	135-170 MHz, Ranger Kit	18.95
ARX-220	220-225 MHz, Ringo Ranger	39.95
ARX-450	435-450 MHz, Ringo Ranger	39.95
FM STACKING KITS		
A14-SK	Stacking Kit for two A147-4	18.95
A14-VPK	Vert. Pol. for two A147-4	29.95
A21-SK	Stacking Kit for two A220-11	19.95
A220-VPK	Vert. Pol. for two A2[illegible]	29.95
A147-SK	Stacking Ki[illegible]7-11	19.95
A147-VPK	Vert. [illegible]	42.95
A449-SK	[illegible] or 11	19.95
A449-VPK	[illegible] for two A44[illegible] or 11	29.95
[illegible]	[illegible]	4.95
[illegible]	[illegible]	4.95
[illegible]	[illegible] Mounting Boom & Bracket	21.95
[illegible]	145 MHz, 10 element	49.95
[illegible]	145 MHz, 20 element	69.95
A432-20T	430-436 MHz, 20 element	[illegible]
[illegible]	50 MHz, 3 element beam	[illegible]
[illegible]	50 MHz, 5 element beam	[illegible]
[illegible]	50 MHz, 6 element beam	[illegible]
[illegible]	50 MHz, 10 el[illegible]	[illegible]
[illegible]	144 MHz, 7 [illegible]	[illegible]
[illegible]	144 MHz, 11 [illegible]	[illegible]
A430-11	[illegible]	37.95
[illegible]	[illegible]-11	19.95
[illegible]	Stacking Kit for two A[illegible]-7	19.95
[illegible]	Stacking Kit for two A430-11	19.95
[illegible]	[illegible] Kit for two A50-3/A50-5	19.95
[illegible]	Stacking Kit for two A50-6/A50-5	29.95
[illegible]	Stacking Kit for four A144-11 Hor. Pol.	139.95
AQX-444	Stacking Kit for four A430-11	109.95
DX ARRAYS - 20 ELEMENT		
DX-120	144 MHz	[illegible]
DX-220	220 MHz	49.95
DX-420	432 MHz	39.95
DX ARRAY BALUNS		
DX-1BN	1-1 Balun for DX-120	15.95
DX-2BN	1-1 Balun for DX-220	15.95
DX-4BN	1-1 Balun for DX-420	15.95
DX ARRAY - 40 ELEMENT STACKING KITS		
DXX-140	Stacking Kit for two DX-120	[illegible]
DXX-440	Stacking Kit for two DX-420	69.95
DX ARRAY - 80 ELEMENT STACKING KITS		
DXX-180	Stacking Kit for four DX-120	[illegible]
DXX-480	Stacking Kit for four DX-420	139.95

The full power, full performance 20-15-10m beam.

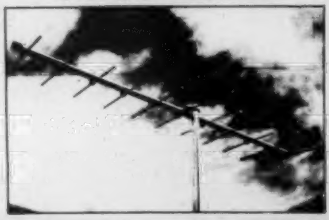
Enjoy the thrill of working rare DX. Increase the pleasure of your daily contacts with A3 interference reducing front-to-back ratio. Use your linear amplifier with confidence with our new high power traps.

6 METER BEAMS

3 - 5 - 6 - 10 ELEMENTS

Description	3 element	5 element	6 element	10 element
Model No.	A50 3	A50 5	A50 6	A50 10
Boom Lngth	6'	12'	20'	24'
Longest El.	117"	117"	117"	117"
Turn Radius	6'	7' 6"	11'	13'
Fwd. Gain	7.5 dB	9.5 dB	11.5 dB	13 dB
F/B Ratio	20 dB	24 dB	26 dB	28 dB
Weight	7 lbs.	11 lbs.	18 lbs.	26 lbs.

3/4 , 1-1/4, 2 METER BEAMS



Model No.	A144 7	A144 11	A220 11	A430 11
Description	2m	2m	1¼m	¾m
Elements	7	11	11	11
Boom Lngth	98"	144"	102"	57"
Weight	4	6	4	3
Fwd. Gain	11 dB	13 dB	13 dB	13 dB
F/B Ratio	26 dB	28 dB	28 dB	28 dB
Fwd. Lobe @ ½ pwr. pt.	46	42	42	42
SWR @ Freq.	1 to 1	1 to 1	1 to 1	1 to 1

DEPARTMENT STORE TUFTS

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Electronic Department Store CATALOG

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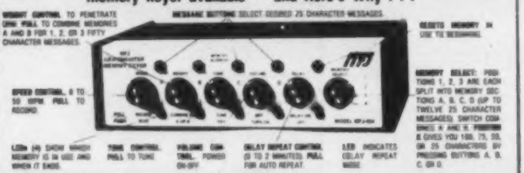
MFJ INTRODUCES THE

NEW! GRANDMASTER MEMORY KEYERS

At $139.95 this MFJ-484 GRANDMASTER

memory keyer gives you more features per dollar than any other memory keyer available — and Here's Why . . .


WEIGHT CONTROL TO PENETRATE QRM. PULL TO COMBINE MEMORIES A AND B FOR 1, 2, OR 3 FIFTY CHARACTER MESSAGES.
MESSAGE BUTTONS SELECT DESIRED 25 CHARACTER MESSAGES.
RESETS MEMORY IN USE TO BEGINNING.
SPEED CONTROL, 8 TO 50 WPM. PULL TO RECORD.
MEMORY SELECT: POSITIONS 1, 2, 3 ARE EACH SPLIT INTO MEMORY SECTIONS A, B, C, D (UP TO TWELVE 25 CHARACTER MESSAGES). SWITCH COMBINES A AND B. POSITION 4 GIVES YOU 100, 75, 50, OR 25 CHARACTERS BY PRESSING BUTTONS A, B, C, OR D.
LEDs (4) SHOW WHICH MEMORY IS IN USE AND WHEN IT ENDS.
TONE CONTROL. PULL TO TUNE
VOLUME CONTROL. POWER ON-OFF
DELAY REPEAT CONTROL (0 TO 2 MINUTES). PULL FOR AUTO REPEAT.
LED INDICATES DELAY REPEAT MODE
MFJ

MEMORY KEYERS

MFJ-484	Grandmaster Memory Keyer. Up to twelve 25 character messages plus a 100, 75, 50, or 25 character message.	139.95
MFJ-482	Grandmaster Memory Keyer. Four 25 or a 50 and two 25 character messages.	99.95
MFJ-481	Grandmaster Memory Keyer. Two 50 character messages.	79.95
HK-1	Optional Squeeze Key.	29.95

PROFESSOR MORSE

MFJ-410	Professor Morse, Random code generator/keyer. Morse code teaching computer. Sends alpha only or alphanumeric, full feature Curtis keyer, speed readout, delay for spacing letters up to three seconds.	149.95

TELEPHONE PATCHES

MFJ-624	Crisp clear professional sounding audio, Vu meter for monitoring line level and for nulling for maximum separation of transmitter and receiver, easy patch in patch out connections	59.95
MFJ-620	Same as MFJ-624 except without meter	49.95

$29.95

MFJ-40T QRP Transmitter

MISCELLANEOUS

MFJ-202	RF Noise Bridge.	59.95
MFJ-1030BX	Receiver Preselector.	49.95
MFJ-200BX	Frequency Standard.	29.95
MFJ-40T	QRP Transmitter.	29.95
MFJ-40V	Companion QRP VFO for 40T	29.95
CPO-555	Code Practice Oscillator	17.95
TK-555	Optional Telegraph Key.	1.95

$49.95

LSP-520BX

$59.95

LSP-520BX II

SPEECH PROCESSOR

MFJ-525	RF Speech Processor. Plugs between.microphone and rig. Powerful natural sounding speech. Vu meter for adjustment of processing, 4 pin mic jack, 6 dB more average SSB power, use with any rig and any mic, push button on-off/bypass.	119.95
LSP-520BX II	Logarithmic Speech Processor. Deluxe model.	59.95
LSP-520BX	Logarithmic Speech Processor.	49.95

$54.95

CMOS-8043 Electronic Keyer

State of the art design uses CURTIS-8043 Keyer-on-a-chip.

• Built-in Key • Dot memory • Iambic operation with external squeeze key • 8 to 50 WPM • Sidetone and speaker • Speed, volume, tone, weight controls • Ultra reliable solid state keying +300 volts max • 4 position switch for TUNE OFF ON SIDETONE OFF • Uses 4 penlight cells • 2-3/16 x 3-1/4 x 4 inches

ELECTRONIC KEYERS

MFJ-8044IC	Deluxe Keyer. Dot and dash memory.	69.95
MFJ-404	Econo Keyer. Built-in paddle, plus extras.	59.95
MFJ-402	Econo Keyer. Built-in paddle.	44.95
MFJ-400	Econo Keyer. External Key.	49.95
MFJ-408	New Deluxe Electronic II, speed readout meter, socket for: Memory, random code generator, keyboard. 8044IC keyer chip dot and dash memory. Up to 50 WPM.	79.95
BY-1	Bencher Deluxe Iambic Paddles. Heavy steel base, non-skid feet.	39.95

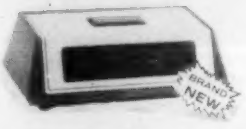
MFJ ENTERPRISES

DELUXE Versa Tuner II

BRAND NEW
MFJ

MFJ-984	Deluxe 3kW Versa Tuner IV. SWR, forward-reflected wattmeter, rf ammeter, dummy load, antenna switch, balun, 3kW PEP	299.95
MFJ-982	3kW Versa Tuner IV. 7 position antenna switch, balun, 3kW PEP	199.95
MFJ-981	3kW Versa Tuner IV. SWR, forward-reflected wattmeter, balun, 3kW PEP	199.95
MFJ-980	3kW Versa Tuner IV. Built-in balun, 3kW PEP	109.95
MFJ-962	1.5 kW Versa Tuner III. SWR, forward-reflected wattmeter, 6 position antenna switch, balun, 1.5kW PEP	169.95
MFJ-961	1.5kW Versa Tuner III. 6 position antenna switch, balun for balanced lines, 1.5kW PEP	149.95
MFJ-949	Deluxe Versa Tuner II. Ultimate in antenna tuners: SWR, dummy load, forward-reflected wattmeter, front panel antenna switch, balun, 300W output.	129.95
MFJ-941B	Versa Tuner II. Improved model with SWR/wattmeter, antenna switch, balun, mobile mounting bracket, 300W output	79.95
MFJ-940	Versa Tuner II. SWR/wattmeter, antenna switch, no balun, no mobile mount, 300W.	69.95
700-0014	Mobile mount for MFJ-940	3.00
MFJ-945	Versa Tuner II. With SWR/wattmeter and mobile mounting bracket, less 6 position antenna switch, 300W	69.95
MFJ-944	Versa Tuner II. With antenna switch and mobile mounting bracket, less SWR/wattmeter, 300W ouput	69.95
MFJ-943	Versa Tuner II. Less SWR/wattmeter, antenna switch mounting bracket, 300W output	59.95
MFJ-901	Versa Tuner. Matches anything. Coax, random wires, balance lines, 200W output.	49.95
MFJ-900	Econo Tuner. Matches coax and random wires. 200W	39.95
MFJ-16010	Random Wire Tuner. For random and long wires, 200W	29.95

24-HOUR DIGITAL CLOCK SOLID-STATE



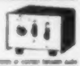
$29.95

24 HOUR DIGITAL CLOCK

MFJ-101	24 hour digital clock, totally solid state, .6" blue display (like TS-820S), ID time, lock function (prevents accidental missetting of time).	29.95

These MFJ active filters are the most copied in Industry.

$29.95 each



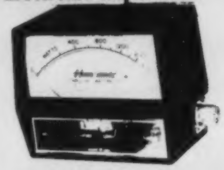
SSB/CW FILTERS

MFJ-752	Dual tunable SSB/CW active filter Signal Enhancer II. 2 noise limiters, inputs for 2 rigs, 110VAC or 12 VDC	79.95
MFJ-751	Tunable SSB/CW active filter Signal Enhancer. 110VAC or 12 VDC.	59.95
MFJ-721	Super CW/SSB Filter. 2W amplifier, noise limiters, inputs for 2 rigs. 12VDC or 110VAC with optional AC adapter.	59.95
MFJ-720	Deluxe Super CW Filter. 2W amplifier, 12VDC or 110VAC with optional AC adapter.	44.95
CWF-2BX	Super CW Filter	29.95
SBF-2BX	Single Sideband Filter	29.95
AC Adapter	12 VDC, 200 mA.	7.95
CWF-2PC	Same wired and tested PC board as in CWF-2BX with 4 position switch	19.95
SBF-2PC	Same wired and tested PC board as in SBF-2BX with 4 position switch	19.95
AC Adapter	6 VDC, 300 mA.	7.95

TUFTS ELECTRONIC

BIRD Electronic Corporation

$99 **VHF model 4362** (140-180 MHz)
$99 **HF model 4360** (18- 30 MHz)



The 4360, 4362 HAM-MATE Directional Wattmeters are insertion type instruments for measuring forward or reflected power in 50-ohm coaxial transmission lines. They are direct descendants of the model 43 THRULINE® Wattmeter – the professional standard of the industry–and will accurately measure RF power flow under any load condition. Each wattmeter is made up of a precisely machined section of 50-ohm line, a rotatable sensing element and meter calibrated in watts, all mounted in a high-impact plastic housing. It is this type of solid construction and the directional THRULINE coupling circuit, **without toroids**, that account for the superiority of the HAM-MATE Wattmeters.

the indispensable BIRD 43 THRULINE WATTMETER

Power Range	Frequency Bands (MHz) 2-30	25-60	100-250	200-500	400-1000
5 watts	–	5A	5C	5D	5E
10 watts	–	10A	10C	10D	10E
25 watts	–	25A	25C	25D	25E
50 watts	50H	50A	50C	50D	50E
100 watts	100H	100A	100C	100D	100E
250 watts	250H	250A	250C	250D	250E
500 watts	500H	500A	500C	500D	500E
1000 watts	1000H	1000A	1000C	1000D	1000E
2500 watts	2500H				
5000 watts	5000H				

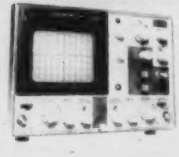
MODEL 43

Elements (Table 1) 2-30 MHz	$135.00
Elements (Table 1) 25-1000 MHz	50.00
	42.00
Carrying case for Model 43 & 6 elements	28.00
Carrying case for 12 elements	17.00

READ RF WATTS DIRECTLY! (Specify Type N or SO239 connectors) 0.45 – 2300 MHz, 1-10,000 Watts ±5%, low insertion VSWR – 1.05. Unequalled economy and flexibility. Buy only the element(s) covering your present frequency and power needs, add extra ranges later if your requirements expand.

HITACHI OSCILLOSCOPES

SPECIAL! 15% OFF ALL HITACHI SCOPES



Single and dual trace, 15 and 30 MHz. All four high sensitivity Hitachi oscilloscopes are built to demanding Hitachi quality standards and are backed by a 2-year warranty. They're able to measure signals as low as 1mV/division (with X5 vertical magnifier). It's a specification you won't find on any other 15 or 30 MHz scope. Plus: Z-axis modulation, trace rotation, front panel X-Y operation for all four scope models, and X10 sweep magnification. And, both 30 MHz oscilloscopes offer internal signal delay lines. For ease of operation, functionally-related controls are grouped into three blocks on the color coded front panel.

- **V-302 30 MHz Dual Trace $850.50**
- **V-301 30 MHz Single Trace $670.50**
- **V-152 15 MHz Dual Trace $625.25**
- **V-151 15 MHz Single Trace $490.50**

ALLIANCE

$99.00

HD-73 HEAVY-DUTY ROTATOR
with exclusive Dual-Speed Control!

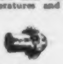
For antennas up to 10.7 sq. ft. of wind load area. Mast support bracket design permits easy centering and offers a positive drive no-slip option. Automatic brake action cushions stops to reduce inertia stresses. Unique control unit features DUAL-SPEED rotation with one five-position switch. SPECIFICATIONS: Max. wind load bending moment – 10,000 in.-lbs. (side-thrust overturning); Starting torque – 400 in.-lbs.; Hardened steel drive gears; Bearings – 100-3/8" diametur (hardened); Meter – D'Arsonval, taut band (back-lighted). There's much, much more.

AMPHENOL BUNKER RAMO

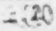
SERIES 31 – BNC CONNECTORS
Amphenol's BNC connectors are small, lightweight, weatherproof connectors with bayonet action for quick disconnect applifications.

Shells, coupling rings and male contacts are accurately machined from brass. Springs are made of beryllium copper. All parts in turn are ASTRO-plated® to give you connectors that can take constant handling, high temperatures and resist abrasion.

BNC BULKHEAD RECEPTACLE 31-221-385 UG-1094 Mates with any BNC plug. Receptacle can be mounted into panels up to 104" thick. $1.25


UG-1094

BNC (M) TO UHF (F) ADAPTER 309-2900-385 UG 255 Adapts any BNC jack to any UHF plug. $3.63


UG-255

DOUBLE MATE ADAPTER 83-877-385 Both coupling rings are free turning. Connects 2 female components. $2.72

83-877-385

JACK ADPATER $1.95 575-102-385 Adapts 83-1SP-385 to Motorola type auto antenna jack or pin jack.

575-102-385

PANEL RECEPTACLE 83-1R-385 SO239 Mounts with 4 fasteners in 21/32" diameter hole. $1.17

PANEL RECEPTACLE

SO239

BNC(F) TO UHF (M) ADAPTER 31-028-385 UG-273 Adapts any BNC plug to any UHF jack. $2.39

UG-273

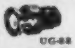
PUSH-ON 83-5SP-385 Features an unthreaded, springy shell to push fit on female connectors. $2.27

83-5SP-385

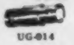
LIGHTNING ARRESTOR 575-105-385 Eliminates static build-up from antenna. Protects your valuable equipment against lightning damage. $4.80

575-105-385

BNC PLUG 31-002-385 UG-88 Commonly used for communications antenna lead cables. For RG 55/U & RG 58/U cables. $1.59


UG-88

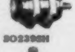
BNC STRAIGHT ADAPTER 31-219-385 UG-914 1 9/32" long, allows length of cables to be joined. Mates with BNC plugs. $2.12


UG-914

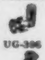
BNC PANEL RECEPTACLE 31-003-385 UG-290 Mounts with 4 fasteners in 29/64" diameter hole. $1.74

UG-290

83-878-385 SO239SH Mounts in single 21/32" diameter hole. Knurled lock nuts prevent turning. $1.59


SO239SH

BNC ANGLE ADAPTER 31-009-385 UG-306 Adapts any BNC plug for right angle use. $4.23


UG-306

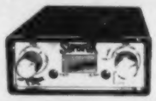
BNC TEE ADAPTER 31-008-385 UG-274 Adapts 2 BNC plugs to 31-003-385 or other female BNC type receptable. $4.86

UG-274

FOX™

First is the Fox XK. It reads all bands and tucks away on the visor.

Our remote (RW) unit is "out-of-sight" when installed. Out-of-sight in performance, too.



And now there's Superfox!

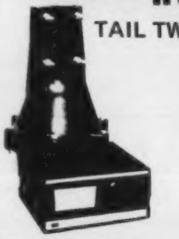
The first remote, superheterodyne radar warning system. Superfox has 10 times the sensitivity capability of any conventional radar detector. It is ideal for custom installations.

PRICE LIST

Order No.	Description	Price
0	**Fox XK** All band detector w/self contained aural/visual alarm	$109.00
0-2	**Fox XK (RW)** All band detector w/remote control, waterproof	$139.00
0-3	**Super Fox** Super-Heterodyne remote radar warning system	$299.95

CDE Two NEW Rotors from Cornell-Dubilier

TAIL TWISTER™



HAM IV

- For the New Super Communications Antennas
- New Thickwall Casting
- New Steel Ring Gear
- New Metal Pinion Gear
- New Motor Prebrake
- New Super Wedge Brake
- New L.E.D. Control Box
- Safe 26 Volt Operation

Designed for the newest of the king-size communications antennas, the TAIL TWISTER™ is the ultimate in antenna rotational devices. The TAIL TWISTER™ starts with a deluxe control box featuring snap action controls for brake and directional controls; L.E.D. indicators signal rotation and brake operation, while the illuminated meter provides direction readout. This new control box couples to the newest bell rotor. Using the time tested bell rotor principle, the TAIL TWISTER™ is a brand new design with thickwall castings and six bolt assembly. A brand new motor with prebrake action brings the antenna system to an easy stop, while the massive square front brake wedge locks the assembly in place. A new stainless steel spur gear system provides final drive into a new steel ring gear for total reliability. Triple race, 138 ball bearing assembly carries dead weight and maintains horizontal stability.

An optional heavy duty lower mast adaptor is available for lighter loads with mast mounting.
Price: $279.00

The HAM IV sets new levels of performance. Snap action switched wedge brake and rotational controls brings pinpoint accuracy to large directional arrays popular in communications. A new motor provides pre-brake action to assist in slowing down rotational mass, and the new thicker wedge brake offers far stronger lock-in phase action. To take full advantage of this new design, the HAM III is designed for in-tower mounting. A new optional heavy duty lower mast adaptor is available when the HAM III is to be mast mounted with smaller arrays. A stainless steel spur gear system multiplies the torque into the dual race 98 ball bearing support assembly assuring years of trouble free performance. **Price: $189.00**

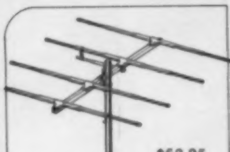
P.O. Box 27, Medford, Mass., 02155

Electronic Department Store CATALOG

TEL. 1-617-391-3200

FINCO STINGER VHF/UHF Antennas

On this page Tufts brings you . . .
Finco Stinger *Hitachi*
Ham-Key *Alliance*



$62.95

10 meter

STINGER A 10-4 DESCRIPTION

The model Stinger A 10-4 is a wide spaced, full size, high gain four element 10-meter monobander designed for optimum DX performance. Utilizing the exclusive Stinger Series square boom construction, the A 10-4 is light enough to be easily stacked for an additional 3 dB gain yet strong enough to withstand the most adverse weather conditions. The highly efficient gamma match system easily withstands 2,000 watts P.E.P. of power and maintains a relatively low V.S.W.R. across the entire 10-meter amateur band.

SPECIFICATIONS – A 10-4

ELECTRICAL–		MECHANICAL–	
Forward Gain	10dB	Boom Length	16 ft.
Front-to-Back Ratio	25dB	Longest Element	18.2 ft.
V.S.W.R. (at resonance)	1.1:1	Turning Radius	7.4 ft.
Half Power Beam Width	50°	Maximum Surface Area	4.4 sq. ft.
Bandwidth	28 to 30 MHz	Wind Load at 80 MPH	110 lbs.
Impedance	50 Ohms	Weight	12.8 lbs.
Matching System	Adjustable Gamma		

2 meter

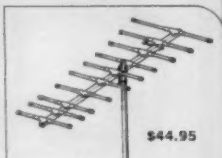
STINGER A 2-10 DESCRIPTION

The model Stinger A 2-10 is a high performance wide spaced ten-element 2 meter yagi designed for the serious VHF operator. Utilizing the Stinger construction features, the A 2-10 is almost indestructable no matter what weather conditions are encountered. Complete coverage of the 2-meter band and low V.S.W.R. is assured through the use of non-linear spaced elements thus also achieving maximum forward gain. Power rating – 2,000 watts P.E.P.

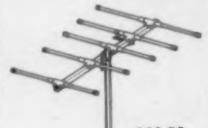
The A 2-10 can be mounted for vertical polarization, there by making the antenna quite useful in repeater operation, or mounted for horizontal polarization for station to station VHF DX work. Additional bays of the A 2-10 can be easily stacked for even greater gain and front-to-back ratio.

SPECIFICATIONS – A 2-10

ELECTRICAL–		MECHANICAL–	
Forward Gain	13.0dB	Boom Length	10 ft.
Front-to-Back Ratio	25dB	Longest Element	42 in.
V.S.W.R. (at resonance)	1.1:1	Turning Radius	71 in.
Half Power Beam Width	40°	Maximum Surface Area	2.28 sq. ft.
Bandwidth	144 to 148 MHz	Wind Load at 80 MPH	29.2 lbs.
Impedance	50 Ohms	Weight	9.8 lbs.
Matching System	Adjustable Gamma		



$44.95



$46.50

6 meter

STINGER A 6-6 DESCRIPTION

The model Stinger A6-6 is a highly directional 6-meter five element beam specifically designed for maximum forward gain with a "no compromise" front to back ratio. The elements are constructed of high tensile strength seamless aluminum tubing plus the exclusive Stinger square boom and bracket assemblies. For maximum power transfer and low V.S.W.R., a carefully designed gamma matching assembly capable of withstanding 2,000 watts P.E.P. is incorporated. Wide element spacing assures optimum DX performance and good operating efficiency across the entire 50 to 54 MHz 6-meter band. The square boom allows optional vertical mounting for accessing 6-meter repeaters.

SPECIFICATIONS – A 6-6

ELECTRICAL–		MECHANICAL–	
Forward Gain	11dB	Boom Length	12 ft.
Front-to-Back Ratio	25dB	Longest Element	10 ft.
V.S.W.R. (at resonance)	1.1:1	Turning Radius	8.3 ft.
Half Power Beam Width	52°	Maximum Surface Area	3.23 sq. ft.
Bandwidth	50 to 54 MHz	Wind Load at 80 MPH	40.2 lbs.
Impedance	50 ohms	Weight	11.5 lbs.
Matching System	Adjustable Gamma		

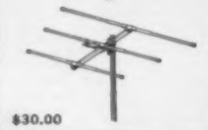
STINGER A 6-3 DESCRIPTION

The model Stinger A 6-3 is a 3-element high gain 6-[illegible] A 6-6 but expressly designed for the casual 6-meter [illegible] finds excellent application for portable use as it [illegible] package. Due to the extra light weight and [illegible] ideal for double stacked and quad stacked arrays [illegible] The A 6-3 is rated at 2,000 watts P.E.P. and [illegible] high tensile strength aluminum elements.

SPECIFICATIONS – A 6-3

ELECTRICAL–		MECHANICAL–	
Forward Gain	[illegible]	Boom Length	6.0 ft.
Front-to-Back Ratio	[illegible]	Longest Element	10 ft.
V.S.W.R. (at resonance)	[illegible]	Turning Radius	5.4 ft.
Half Power Beam Width	[illegible]	Maximum Surface Area	1.75 sq. ft.
Bandwidth	[illegible]	Wind Load at 80 MPH	17.5 lbs.
Impedance	[illegible] Ohms	Weight	7 lbs.
Matching System	[illegible] Gamma		

Sale–15% off Finco!



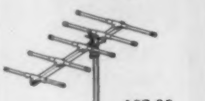
$30.00

STINGER A 2-6 DESCRIPTION

The model Stinger A 2-6 is a five-element high gain antenna similar to the A 2-10 but having physically less of a profile. The A 2-6 finds excellent application as a portable antenna as it disassembles into a [illegible] compact package. Like the A 2-10, the antenna can be mounted for vertical or horizontal polarization for repeater or general coverage work. Constructed of the Stinger heavy duty materials, the A 2-6 is ideal for locations encountering adverse weather conditions. Power rating 2,000 watts P.E.P.

SPECIFICATIONS – A 2-6

ELECTRICAL–		MECHANICAL–	
Forward Gain	[illegible]	Boom Length	5.5 ft.
Front-to-Back Ratio	[illegible]	Longest Element	41 in.
V.S.W.R. (at resonance)	[illegible]	Turning Radius	42 in.
Half Power Beam Width	[illegible]	Maximum Surface Area	1.23 sq. ft.
Bandwidth	144 to [illegible]	Wind Load at 80 MPH	13.2 lbs.
Impedance	50 Ohms	Weight	6.5 lbs.
Matching System	Adjustable Gamma		



$27.95

STINGER A 2+2 DESCRIPTION

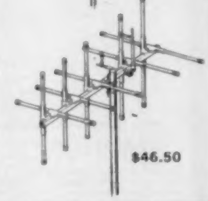
[illegible] 2+2 is a ten-element, dual polarization 2-meter antenna [illegible] communications or where switching from horizontal to [illegible] is required. The A 2+2 can even be phased to operate on [illegible] and vertical polarization at the same time. This is not only [illegible] OSCAR work but gives your station versatility for ground communication.

Wide, non-linear element spacing gives the A 2+2 superior gain, however, since it is a five element beam in any given plane, the half power beam width does not make satellite tracking difficult because of sharp directivity. The dual gamma match assemblies provide for a very low V.S.W.R. and will withstand 2,000 watts P.E.P.

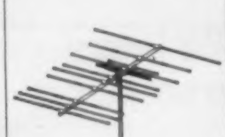
The Stinger construction features make the A 2+2 extremely heavy duty. Provisions are made for mounting the antenna at the end of the boom – for azimuth control – or at the middle of the boom for normal applications.

SPECIFICATIONS – A 2+2

ELECTRICAL–		MECHANICAL–	
Forward Gain	9.5dB	Boom Length	8 ft.
Circular Gain	10.5dB	Longest Element	41 in.
Front-to-Back Ratio	20dB	Turning Radius–	
Half Power Beam Width		End Mount	5.5 ft.
Horizontal Polarization–		Center Mount	3.4 ft.
E Plane 52° H Plane	58°	Maximum Surface Area	1.51 sq. ft.
Vertical Polarization–		Wind Load at 80 MPH	13.4 lbs.
E Plane 58° H Plane	52°	Weight	11 lbs.
Circular Polarization–			
E Plane 52° H Plane	52°		
Bandwidth	144 to 148 MHz		
Impedance	50 Ohms		
Matching System	Adjustable Gamma		



$46.50



$74.95

6 and 2 meter

STINGER A 62 DESCRIPTION

The model Stinger A 62 is a truly remarkable combination 6 and 2-meter beam designed for optimum performance on both bands yet only requiring ONE transmission line. This is accomplished through the use of exclusive interlacing elements to accomplish dual band operation with no sacrifice to either band – NO SWITCHING REQUIRED!

On 2-meters, the A 62 has 6 collinear elements – equivalent to three 1/2 λ 6-element yagis stacked side by side – thus giving outstanding performance. Maximum forward gain is assured on 6-meters through the use of four wide spaced elements. The heavy duty Stinger construction is used throughout so that the antenna will withstand 100 mph plus wind loads.

The A 62 is ideal for mounting on the same mast as your tri-bander or other antenna thus easily opening up the world of 6 and 2 meter VHF communication.

SPECIFICATIONS – A 62

ELECTRICAL–		MECHANICAL–	
Forward Gain	6 meters 9.5dB 2 meters 12.5dB	Boom Length	10.1 ft.
Front-to-Back Ratio	6 meters 15dB 2 meters 22dB	Longest Element	10 ft.
V.S.W.R. (6 & 2 meters)	1.1:1	Turning Radius	6.7 ft.
Half Power Beam Width	40° to 60°	Maximum Surface Area	4.48 sq. ft.
Bandwidth	6 meters 50 to 54 MHz 2 meters 144 to 148 MHz	Wind Load at 80 MPH	42 lbs.
Impedance	50 ohms	Weight	13.8 lbs.
Matching System	Adjustable Gamma		

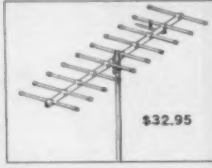
1 1/4 meter

STINGER A 1 1/4 – DESCRIPTION

The model Stinger A 1 1/4 is a ten element 1 1/4-meter (220 MHz) high performance yagi designed for all 220 MHz communication needs. Designed to be mounted in either the vertical or horizontal plane, the A 1 1/4 is adaptable for OSCAR, repeater, or general communication work. Incorporating the Stinger heavy duty elements, boom and boom to mast assemblies, the antenna easily withstands 120 mph wind loads under 1/4" ice conditions. A low loss gamma matching system assures a low V.S.W.R. and is power rated at 1,000 watts.

SPECIFICATIONS – A 1 1/4

ELECTRICAL–		MECHANICAL–	
Forward Gain	13.0dB	Boom Length	8 ft.
Front-to-Back Ratio	25dB	Longest Element	26 in.
V.S.W.R. (at resonance)	1.2:1	Turning Radius	4.3 ft.
Half Power Beam Width	40°	Maximum Surface Area	1.22 sq. ft.
Bandwidth	220 to 226 MHz	Wind Load at 80 MPH	17.5 lbs.
Impedance	50 Ohms	Weight	8 lbs.
Matching System	Adjustable Gamma		

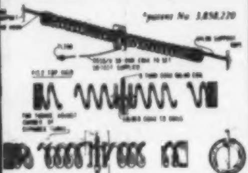


$32.95

slinky

$39.95

SLINKY! $43.95 Kit A LOT of antenna in a LITTLE space New Slinky® dipole* with helical loading radiates a good signal at 1/10 wavelength long!



*patent No 3,858,220

This electrically small 80/75, 40 & 20 meter antenna operates at any length from 24 to 70 ft. ● no extra balun or transmatch needed ● portable – erects & stores in minutes ● small enough to fit in attic or apt. ● full legal power ● low SWR over complete 80/75, 40 & 20 meter bands ● much lower atmospheric noise pick-up than a vertical & needs no radials ● kit incl. a pr. of specially-made 4" dia. by 4" long coils, containing 335 ft. of radiating conductor, balun, 50 ft. RG58/U coax, PL259 connector, nylon rope & manual.

HAM-KEY

TM

Model HK-3M

$19.95

- * Deluxe straight key
- * Anti-tip bracket. Can't tip
- * Heavy base. No need to attach to desk
- * Navy type knob
- * Smooth action

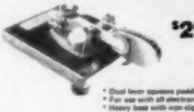
CC 3P shielded cable & plug for HK 3M $2.49

Add $ .50 Shipping & Handling

Model AT 8 anti-tip bracket only, to convert any HK 3 to HK 3M $2.99

RADIO TELEGRAPH SENDING DEVICES

Model HK-1



$29.95

- * Dual lever squeeze paddle
- * For use with all electronic keyers
- * Heavy base with non-slip rubber feet
- * Paddles reversible for wide or close finger spacing

CC 1P shielded cable & plug for HK 1 $3.75

Model HK 2, same as HK 1 but less base for incorporation in your own keyer $19.95

Model HK-4

$44.95

- * Combination HK 1 & HK 3 on same base
- * Straight key may be used conventionally or as a switch to trigger a memory

CC 1/3P Shielded cable with plugs for HK-4 $3.99

Model HK-5A Electronic Keyer

$69.95

- * Iambic circuit for squeeze keying
- * Self completing dots & dashes
- * Dot & dash memory
- * Built-in sidetone
- * Uses Curtis 8044 keyer chip
- * Grid block or direct keying
- * Speed, volume, tone & weight controls on front panel
- * Use with HK 1 or HK-4
- * Battery operated with provisions for external power

DATONG

$219.95

MODEL FL1

Frequency – Agile Audio Filter

The Datong Frequency-Agile Audio Filter is intended primarily for post-detector signal filtering in RF and LF communications receivers for SSB and CW. It offers an unusually versatile combination of benefits to the user including:

For the SSB operator:

- Fast automatic suppression of interfering heterodyne whistles in the range 280–3000 Hz by a unique search-lock-and-track notch filter. The tracking notch can be left in circuit with no audible effect until a whistle appears in which case the whistle will 'disappear' within typically one second.
- A continuously adjustable audio 'window' or a variable-width notch to improve reception in the presense of other off-tune SSB, RTTY or SSTV signals.

For the CW operator:

- Continuously variable center-frequency (280–3000 Hz) and bandwidth (25–1000 Hz) for perfect matching of receiver passband to changing band conditions, sending speeds, and personal preference.
- Flat-topped, steep-skirted response shape for optimum ease of tuning combined with excellent noise rejection.
- Linear tuning law with bandwidth independent of frequency and gain independent of bandwidth for natural 'feel'.

TUFTS ELECTRONIC

CATALOG Electronic Department Store

VIBROPLEX

THE IAMBIC KEYER PADDLE. Features include: adjustable jeweled bearings ("Deluxe" only); tension and contact spacing fully adjustable; large, solid, coin silver contact points; 2½ lb. chrome plated steel base rests on non-skid feet; lifetime guarantee against manufacturing defects.

"Standard" model with textured gray base. $49.50.

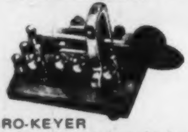
"Deluxe" model with chrome plated base. $65.00

THE IMPROVED "ORIGINAL" VIBROPLEX. Suitable for All Classes of Transmitting Work Where Speed and Perfect Morse Are Prime Essentials. This great new Vibroplex is a smooth and easy working BUG. It has won fame on land and sea for its clarity, precision and ease of manipulation. Can be slowed down to 10 words per minute or less or geared to as high rate of speed as desired. Maintains the same high quality signal at whatever speed, insuring easy reception under all conditions. Weight 3 lbs. 8 oz. Standard $56.95

DeLuxe — Chromium base and top parts, with jeweled movement. $69.95

THE "LIGHTNING BUG" VIBROPLEX High Quality Signals at All Speeds. Flat pendulum model. Weight 3 lbs. 8 oz. Standard — Polished Chromium top parts, grey base. $69.95
Standard $56.95

THE "CHAMPION" VIBROPLEX
Weight 3 lbs. 8 oz. Without circuit closer. Standard finish only. Chromium finished top parts, with grey crystal base. $56.95



VIBRO-KEYER
Over the years, we have had many requests for Vibroplex parts to be used for construction of a keying mechanism for an electronic transmitting unit. This beautiful and most efficient "Vibro Keyer" is ideal for this job.

FEATURES OF THE "VIBRO-KEYER"

- Beautiful beige colored base, size 3½" x 4½", weight 2¾ pounds
- Same large size contacts as furnished on Deluxe Vibroplex.
- Same main frame and super finished parts as Deluxe Vibroplex

Standard —.$49.50; Deluxe Finish $65.00

No. SSK-1 $23.95
No. SSK-1CP-Chrome – $29.95

NYE VIKING SQUEEZE KEY

Extra-long, finger-fitting molded paddles with adjustable spring tension, adjustable contact spacing. Knife-edge bearings and extra large, gold plated silver contacts! Nickel plated brass hardware and heavy, die cast base with non-skid feet. Base and dust cover black crackle finished. SSK-1 — $23.45.
SSK-1CP has heavily chrome-plated base and dust cover. Price — $32.95

CODE PRACTICE SET You get a sure, smooth, Speed-X model 310-001 transmitting key, linear circuit oscillator and amplifier, with a built-in 2" speaker, all mounted on a heavy duty aluminum base with non-skid feet. Operates on standard 9V transistor type battery (not included). Price — $20.75

PHONE PATCH Model No. 250-46-1 measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. List price, $36.50. Model 250-46-3, designed for use with transceivers having a built-in speaker, has its own built-in 2" x 6" 2 watt speaker. Measures 6-1/2" wide, 2-1/4" high and 2-7/8" deep. Price — $46.50

No. 114-320-003 – $11.70
No. 114-322-003 – Brass – $12.10

No. 114-320-001 – $9.70
No. 114-322-001 – Brass – $10.15

No. 114-310-003 – $9.65
No. 114-312-003 – Brass – $10.25

NYE VIKING SPEED-X KEYS
NYE VIKING Standard Speed-X keys feature smooth, adjustable bearings, heavy-duty silver contacts, and are mounted on a heavy oval die cast base with black wrinkle finish. Available with standard, or Navy knob, with, or without switch, and with nickel or brass plated key arm and hardware.

Pamper yourself with a Gold-Plated NYE VIKING KEY!
Model No. 114-31C-004GP has all the smooth action features of NYE Speed-X keys in a special "presentation" model. All hardware is heavily gold plated and it is mounted on onyx-like jet black plastic sub-base. Price $50.00

ALL BAND PREAMPLIFIERS

AMECO

- 6 THRU 160 METERS
- TWO MODELS AVAILABLE
- RECOMMENDED FOR RECEIVER USE ONLY
- INCLUDES POWER SUPPLY

MODEL PLF employs a dual gate FET providing noise figures of 1.5 to 3.4 db., depending upon the band. The weak signal performance of most receivers as well as image and spurious rejection are greatly improved. Overall gain is in excess of 20 db. Panel contains switching that transfers the antenna directly to the receiver or to the Preamp. Model PLF 117V AC, 60 Hz. Wired & Tested $49.95

Now you can receive the weak signals with the Ameco PT-2 pre-amplifier!

Model PT-2 is a continuous tuning 6-160 meter Pre-Amp specifically designed for use with a transceiver. The PT-2 combines the features of the well-known PT with new sophisticated control circuitry that permits it to be added to virtually any transceiver with no modification. No serious ham can be without one. Price: $74.95.

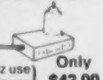
- Improves sensitivity and signal-to-noise ratio.
- Boosts signals up to 26 db.
- For AM or SSB.
- Bypasses itself automatically when the transceiver is transmitting.
- FET amplifier gives superior cross modulation protection.
- Simple to install.
- Advanced solid-state circuitry.
- Improves immunity to transceiver front-end overload by use of its built-in attenuator.
- Provides master power control for station equipment.

AMECO

Larsen Külrod Antennas

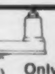
- Handle full 200 watts
- low-low V.S.W.R.
- Deliver 3 dB gain and more!
- Pick the one that best fits your needs:

MAGNETIC MOUNT
stays put even at 100 mph!



MM-JM-150 for 144 MHz use
MM-JM-220 for 220 MHz use
MM-JM-440 for 440 MHz use
Only $42.00 complete

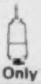
TRUNK LID MOUNT
No holes and low silhouette too!



TLM-JM-150 for 144 MHz use
TLM-JM-220 for 220 MHz use
TLM-JM-440 for 440 MHz use
Only $42.00 complete

And 1/4 wave antenna for trunk and magnetic mount – $18.50

ROOF or FENDER MOUNT
Goes on quick and easy in 3/8" or 3/4" with fewest parts.

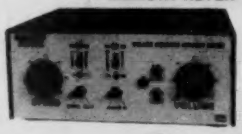


JM-150-K for 144 MHz use
JM-220-K for 220 MHz use
JM-440-K for 440 MHz use
Only $34.50 complete

And 1/4 wave antenna for roof and fender mounts $11.50

TRAC $89.95 "BRAND NEW"

DELUXE MESSAGE MEMORY KEYER



Features: Model TE-284

- State-of-the-Art CMOS Circuitry
- Three choices of Message Storage
  - A. Two [illegible] character each message storage
  - B. Four [illegible] character each message storage
  - C. One [illegible] character and two [illegible] character message storage
- Records at any speed—plays at any speed
- Memory operating LED
- Use for daily QSO or contests
- Self-completing dots and dashes
- Both dot and dash memory
- IAMBIC keying with any squeeze paddle
- 5-50 w.p.m.
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid state rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

MESSAGE MEMORY KEYER

Model # TE201 $69.95

Features:

- Advanced CMOS message memory
- Two (50 char. each) message storage
- Repeat function
- Records at any speed—plays back at any speed
- Longer message capacity
- 5-50 wpm
- Speed, volume, tone, tune and weight controls
- Sidetone and speaker
- Low current drain CMOS battery operation—portable
- Deluxe quarter-inch jacks for keying and output
- Keys grid block and solid state rigs
- WIRED AND TESTED FULLY GUARANTEED—LESS BATTERY

Model # TE144

"BRAND NEW" 59.95

Features: Deluxe CMOS Electronic Keyer

State-of-the-art CMOS circuitry
Self completing dots and dashes
Both dot and dash memory
IAMBIC keying with any squeeze paddle 5-50 wpm
Speed, weight, tone, volume tune controls & sidetone and speaker
Semi-automatic "bug" operation & straight keying—rear panel switch
Low current drain CMOS battery operation—portable
Deluxe quarter inch jacks for keying and output
Keys grid block and solid state rigs
Wired and tested—fully guaranteed—less battery

MODEL TE133—*same as TE144 with wgt and tone control internal, less semi-auto keying.* $49.95

MODEL TE122—*same as TE133 less wgt, tune, solid state keying.* $36.50

ASTATIC MICROPHONES

T-UP9-D104 transistorized w/push bar base	$67.50
T-UG8-D 104 transistorized.	$55.50
T-UG9-D 104 "Silver Eagle" transistorized.	$74.40
UG-D 104 ceramic or crystal . . .	$49.50

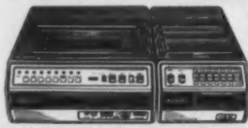
P.O. Box 27, Medford, Mass., 02155

DEPARTMENT STORE TUFTS

Electronic Department Store CATALOG

Panasonic

VHS. If You Can't Remember The Letters Remember The Name. Panasonic.



PV-2600 VTR
PK-2600 Tuner
Both for only $1238

Panasonic Portable/Home 6-Hour Video Cassette Recorder
Three-way portable operation: house current, car/vehicle battery or self-contained rechargeable battery. Records at home up to 6 hours with seperate power supply that houses electronic pushbutton VHF and UHF tuners and digital clock/timer with time-limit function. Pushbutton solenoid operation. Hooks up to any TV. Comes with attachable shoulder belt and rechargeable battery.

Watch What You Want . . . When You Want

$899

PV-1200
Panasonic's 6-hour VHS video recorders are as easy to use as an ordinary audio tape recorder. They connect to your home TV and let you record your favorite programs* —up to 6-hours worth on 1 cassette. And they're yours for keeps to watch whenever you want. And like any recorder, you can even erase the tape and record a TV program over and over again. Panasonic's

$995
PV-1600

PV-1600 features a 7-day programmer for a full-week of automatic recording** (up to 4 programs). Both VHS home recorders feature built-in clock timers, 6-hour recording capability, and a name you can depend on: Panasonic.

Panasonic Omnivision VI VHS™
6-Hours of TV Programming Onto One Cassette

RCA

6-HOURS RECORDING ON ONE CASSETTE

RCA has a full line of Video Cassette Recorders and accessories to choose from — pick the items that suit your needs.

VDT501:	Features built-in 24-hour digital clock timer.	$899
VDT600:	7-day Programmer with electronic touch-button tuning.	$1049
VDT625:	7-day Programmer — plus slow motion, double speed and stop action playback control.	$1199
CC004:	Don't forget the RCA *Color Camera.*	$799
VDP150:	Portable VCR recorder (includes VK125 cassette, earphone, handle, battery, remote pause control).	$995
TDP1000:	Tuner/Timer Module (includes antenna adaptors and hookup cables).	$299
PDP500:	AC Power Supply/Battery Charger (includes antenna adaptors and hookup cables).	$139
VK125:	125-meter tape. Plays up to 3 hours.	case lot prices
VK250:	250-meter tape. Plays up to 6 hours.	available

Sharp Calculators

SALE! All Sharp Calculators 10% OFF Listed Price!!

Desk Top Display/Printer

$89.95
EL-1182

- Bright green display with automatic three-digit punctuation and standard paper printout.
- Compact design with positive action keyboard. Speedy, versatile performer.

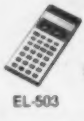
$89.95
EL-1166

- Clear, easy-to-read printout of 10 digits on standard roll paper.
- Bright green fluorescent display.

$129.95
EL-2168

- 12-digit standard paper printer, bright green fluorescent display.
- 4-key memory, item counter, add-mode, fixed and floating decimal.

Scientific



$16.95
EL-503

- Trigonometric, inverse trigonometric and logarithmic functions... parentheses.
- LCD and long life battery operation.

$24.95
EL-506

- Trigonometric, inverse trigonometric and logarithmic functions with up to three parentheses.
- Liquid Crystal Display, long life battery operation.

$39.95
EL-5808

- Scientific functions, 8-digit mantissa, 2-digit exponent and statistical functions.
- Super thin styling, 3/16", Sensor Touch™.

Basic

$10.95
EL-211

- Three-key memory, percent key.
- Low power consumption for long battery life.

$12.95
EL-210

- 5-key independently accessible memory.
- Easy-to-read, bright green fluorescent display.

$12.95
EL-8146

- 8-digit liquid crystal display.
- 4-key memory and wallet.

Alphanumeric Scientific

- Alphanumeric, scientific calculator with 24-character dot-matrix, rolling writer LCD. Solves formulas with up to 80 steps.
- A total of 61 scientific and statistical functions, Auto Power Off and Memory Safe Guard™ in a pocket-computer size and shape.

$99.95

EL-5100

$79.95
EL-5101

- Direct formula entry, scientific calculator stores and solves formulas with up to 48 steps.
- 16-character dot-matrix liquid crystal rolling writer display.

TUFTS ELECTRONIC

TEL. 1-617-391-3200

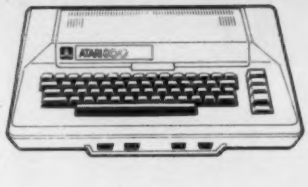
CATALOG Electronic Department Store

ATARI®

A Warner Communications Company

All items in stock for immediate delivery.

ATARI® 800™ PERSONAL COMPUTER SYSTEM



ATARI 800

The ATARI 800 is a top-of-the-line personal computer system. Its expandable memory, advanced peripheral components, comprehensive software library, and modular design assure that it will never become obsolete.

Whether it's for business and household management, education, or entertainment, the ATARI 800 can be tailored to specific needs and has been designed to change as those needs change. This "timeless" computer system can be used by people with no previous computer experience, although it doesn't compromise capability for the sophisticated user.

SOFTWARE LIBRARY

The hardware which makes up the ATARI 800 Personal Computer System is only half the story.

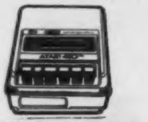
The other half is ATARI's complete software library. You get a full choice of ROM cartridge, tape cassette, and diskettes that give you complete control in shaping your computer's character and applications. For data management. For problem solving. For education. For fun and games.

You can even create and apply your own programs. ATARI's BASIC Language cartridge gives you direct access to your computer's central processing unit, memory and color, sound and file transfer capabilities. So you can design, write and implement your own programs. Or modify existing ones to suit your needs. Easily. Even if you've never talked to a computer before.

ATARI® 830™ MODEM

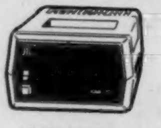
ATARI® 850™ INTERFACE MODULE

ANNOUNCING A NEW GENERATION OF PERSONAL COMPUTERS BY ATARI®



ATARI 410 Program Recorder

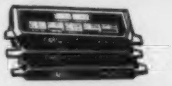
Comes supplied with your ATARI 800 Personal Computer. The program recorder gives you the ability to utilize any ATARI pre-recorded tape cassette program. It also lets you store your own programs on audio cassette tapes. It can store up to 100K bytes per 60 minute tape.



ATARI 820 Printer

(Optional)

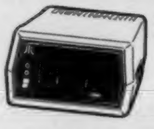
High resolution, dot-matrix impact printer uses inexpensive, standard roll paper. Prints more than 2,000 characters per minute to provide permanent printed records of program listings and program results.



ATARI Memory Modules

(Optional)

Unique 8K and 16K plug-in RAM modules let you instantly expand your computer's internal memory up to 48K.

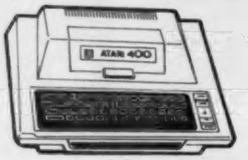


ATARI 810 DISC DRIVE

(Optional)

Uses standard 5¼" diskettes to add up to 88K bytes of rapid access information storage for each diskette. As many as four 810 Disk Drive units can be operated simultaneously and accessed individually.

ATARI® 400™ PERSONAL COMPUTER SYSTEM

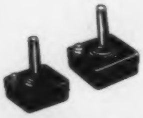


ATARI 400

The ATARI 400 Personal Computer is just that: a computer that you can use. It's easy to own. And easy to operate. Even if you've never used a computer before.

But don't let its simple operation fool you. The ATARI 400 is a full-fledged general purpose computer that can go a long way towards simplifying your complex life.

All you have to do is pick a program from ATARI's comprehensive library of plug-in cartridge and cassette tape software. Everything from small business management to home finance and computerized education. Plus some of the most challenging, most exciting computer games ever.



JOYSTICK CONTROLLERS

PADDLE CONTROLLERS

ROM PROGRAMS

CASSETTE PROGRAMS

The system

The **ATARI 800™** system provides easy access to a wide variety of household information. Uses such as music composition, electronic art, and household security control are all planned applications for the **ATARI 800** system. The educational and entertainment value built into the system is endless.

For professional use, the **ATARI 800** is expandable to keep up with the needs of most small businesses, and with the needs of large businesses where the central computer is overloaded.

Business & household management

- **Personal Financial Management** Income and expense record keeping keyed to rapid retrieval for income tax purposes.
- **Record Keeping** Books, records, serial numbers, insurance policies.
- **Charge Account Management** (With check printing).
- **Personal Capital Investment Management** Stocks, bonds, real estate, with stock quotation service.
- **Mailing List/Address Book** (With printing).
- **Computerized Appointment Calendar**
- **Inventory Management**
- **Accounts Payable**
- **Touch-typing Trainer**
- **Payroll**

Educational applications

The exclusive **ATARI 800 Educational Library** on audio/digital cassettes, contains over 20 subjects, including:

- Algebra
- Economics
- Auto Mechanics
- Sociology
- U.S. History
- Zoology
- Counseling Procedures
- Vocabulary Builder
- Basic Psychology
- Spelling
- Spanish
- Accounting
- Carpentry
- Great Classics
- Statistics
- Basic Electricity
- World History

Direct interaction with the computer takes place through the keyboard, television screen, and speaker. This running dialogue between the user and the computer is highlighted by immediate feedback on accuracy and understanding.

Entertainment applications

The **ATARI 800** is capable of playing sophisticated thinking and action games. The **Entertainment Program Library** consists of:

Thinking games
Chess
Backgammon
Business Simulations
Stock Market Simulation
Space Adventure
Strategy Games

Action games
Four-Player Basketball
Superbug™ Driving Game
Game of Life
Super Breakout™

P.O. Box 27, Medford, Mass., 02155

DEPARTMENT STORE TUFTS

TEL. 1-617-391-3200

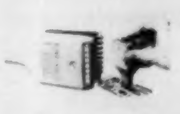
INSTRUMENTS AND BREADBOARDING EQUIPMENT

CONTINENTAL SPECIALTIES CORPORATION

MAX-100: 100 MHz 8-DIGIT FREQUENCY COUNTER

Laboratory accuracy for the shop or field!

- Measures 20 Hz – 100 MHz guaranteed – better than 500 MHz with Prescaler
- Easy reading, bright eight-digit 0.6" LED display
- *Direct* readout with 1 Hz resolution
- Fully automatic – no switches to set
- Crystal timebase accurate to 3 ppm
- Rugged, low-drain design operates on alkaline/NiCad batteries or AC line, with adaptors



$59.95

LM-1 CIRCUIT-POWERED LOGIC MONITOR

This self-contained, compact, pocket-sized unit simultaneously reads the logic state of every node of any DTL, TTL, HTL or CMOS DIP IC up to 16 pins. Completely automatic, it requires no set up, calibration or adjustment . . . even powers itself *automatically* from the circuit under test, with its own power-seeking gate network. Fast, accurate and reliable, LM-1 can cut testing and troubleshooting time to a fraction of ordinary test methods.
Stock No: 06-0010

LM-1 LOGIC MONITOR

Input Impedance: 100,000 Ohms
Input Threshold: 2 V ± 0.2 V
Input Voltage Range: 4 VDC minimum, 15 VDC maximum across any 2 or more input leads
Maximum Input Frequency: 10 KHz, 50% duty cycle at 100 KHz when input signal swing exceeds threshold voltage by more than 0.5 VDC
Maximum Current Drain: 200 mA @ 10 VDC
Operating Temperature: 0°C to 50°C
Maximum Dimensions (LxWxD): 4.0" x 2.0" x 1.5" (102 x 51 x 38mm)
Weight: 3 oz. (85 gm)

PS-500 PRESCALER.

NEW!

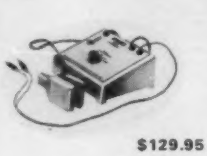
Accurately extends any 50 MHz counter up to 500 MHz and above!

- Compatible with all standard counter inputs
- 250 mV sensitivity, 400 mV min. output
- Compact, rugged solid-state unit
- 50-ohm BNC input
- Switch for either prescaler (÷ 10) or straight-thru operation

Extend the range of your 50/100 MHz counter to over 500 MHz, with our Model PS-500. This lightweight unit – the perfect companion to our MAX-50 or MAX-100 – is a precision, divide-by-ten prescaler providing 400mV peak-to-peak output – enough to drive the least sensitive counter. Its BNC-terminated input, is sensitive down to 250 mV. No need to disconnect the unit – Prescaler switches in or out of the line at will. It may be powered by external batteries, AC adaptors or from an auto cigarette lighter, making it ideal for lab, shop or service vehicle.

Now CSC's MAX-50, MAX-100 or *any 50 MHz counter can be extended to cover the entire VHF range, into UHF* for precision lab and field measurements up to 500 MHz and beyond.
Stock No: 05-0500

$59.95



$129.95

LM-2 ADVANCED, LINE-POWERED LOGIC MONITOR

With its independent power supply, the LM-2 fills the need for a fully-isolated Logic Monitor entirely free of test-circuit loading – eliminating unwanted logic level shift, false triggering or extra power supply drain! For checking CMOS circuits LM-2 even has a separate cable for sensing supply voltage in setting internal comparator levels.

When the unit's connector/display is clipped over a DIP LM-2's self-contained power supply provides constant-current drive for uniformly bright indication. And the logic family selection switch, in conjunction with LM-2's IC comparators, provides an accurate reference for measurement of RTL, DTL, HTL and CMOS DIP IC's.
Stock No: 06-1020

LM-2 LOGIC MONITOR

RTL Logic Threshold: 1.2 VDC ± 100 mV
DTL Logic Threshold: 1.6 VDC ± 100 mV
TTL Logic Threshold: 2.4 VDC ± 100 mV
HTL Logic Threshold: 7.5 VDC ± 100 mV
CMOS Logic Threshold: 70% of tested Vcc ± 100 mV
Maximum Useful Input Frequency: 30 KHz @50% duty cycle
Input Power: 105-125 VAC, 50/60 Hz, 10W, optional 220-240 VAC, 50/60 Hz available
Power Supply Module Dimensions (LxWxD): 5.6" x 6.0" x 3.0" (142 x 152 x 76mm)
Weight: 20 oz. (567 gm)

PROTO-CLIP™ IC TEST CLIPS:

Fast, easy, in-circuit DIP testing

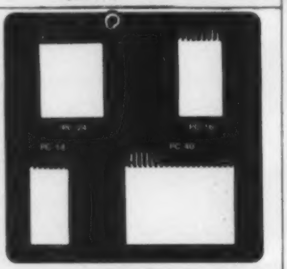
- Brings IC leads up from crowded PC boards
- Self-aligning, non-corroding contacts
- Unique slip-proof teeth . . . free hands for other work
- Available with cable, and clips on one or both ends

Proto-Clip connectors put an end to the high cost of damaging expensive ICs during testing! They provide foolproof, short-proof, in-circuit IC testing by clipping over any size DIP up to 40-pin and extending its leads well above the crowded surface of the circuit board. Tracing, testing, signal injection . . . even patching-in other circuits is now easy and fast, even in the tightest quarters.

Proto-Clips are molded of high-impact plastic with a flexible web hinge.* Non-corroding nickel-silver contact teeth provide positive, low-resistance connections to all IC leads.

Proto-Clip IC test clips offer an exclusive time- and money-saving feature: unique, non-slip contact pins that prevent probes from shorting-out costly ICs.

Available plain, or pre-wired with flat ribbon cable rated at 150V with clips at one or both ends.



PROTO-CLIPS (non-wired)

		Stock No
PC-14	(14 pin)	08-1014
PC-16	(16 pin)	08-1016
PC-24	(24 pin)	08-1024
PC-40	(40 pin)	08-1040

PROTO-CLIPS (with pre-wired cables)

Model No.	Cable Length Inches	Stock No Single Clip	Stock No Dual Clip
PC-14-	18 24 36	08-9814 08-9414 08-9614	19-1814 19-2414 19-3614
PC-16-	18 24 36	08-9816 08-9416 08-9616	19-1816 19-2416 19-3616
PC-24-	18 24 36	08-9824 08-9424 08-9624	19-1824 19-2424 19-3824
PC-40-	18 24 36	08-9840 08-9440 08-9640	19-9840 19-9440 19-9640

THE LOGIC MONITORS: INSTANTLY MONITOR LOGIC STATE OF ALL IC NODES SIMULTANEOUSLY!

An indispensable tool that speeds design, debugging and service.

- Faster than a scope
- Safer than a voltmeter
- More information than either
- No sync or level problems

Circuit analysis, debugging and repair problems are instantly minimized when a CSC Logic Monitor is clipped onto any 14 or 16 pin DIP IC. Its instant display of the static and dynamic logic states of every node permits designers and technicians to quickly: locate unused elements; isolate gates for detailed investigation; identify non-functioning components; monitor during IC burn-ins or long-term testing; even test temperature and voltage-change effects. These incredibly helpful instruments permit step-by-step or dynamic signal tracing through counters, shift registers, flip-flops, gating networks, decoders – even entire systems consisting of mixed logic families! Each clip contact connects to a single logic comparator with LED readout, activated when the applied voltage exceeds a fixed threshold. Logic "1" (hi voltage) turns LED on, logic "0" (low voltage or open circuit) keeps it off. These compact, easy-to-interpret instruments provide the capability of a 16 channel oscilloscope – without its expense, bulk or power consumption.

THE DP-1 DIGITAL PULSER: THE PORTABLE, AUTOMATIC, CIRCUIT-POWERED DIGITAL PULSE SOURCE.

Automatically delivers proper level and polarity – cuts hours from trouble-shooting time.

- Automatically senses polarity of the IC node it's applied to
- Automatically delivers – on command – the proper pulse level and polarity to compliment a node's logic level
- Works with TTL/DTL and HTL/CMOS circuits
- Provides single pulses to "jog" circuits or 100 pps pulse train, at the push of a button
- Circuit-powered design eliminates bulky power-supplies; facilitates easy use in field-service applications
- Ideal for use with Logic Probes, Logic Monitor™

PRICE LIST

LOGIC MONITORS AND PROBES

LM-1	$ 59.95
LM-2	129.95
LP-1	44.95
LP-2	24.95
LP-3	69.95
DP-1	74.95

PROBE AND PULSER ACCESSORIES

LDA-1	$1.00
LDA-2	1.00
LDA-3	4.25
LDA-4	2.75
LDA-5	1.95
LDA-6	2.95
LDA-7	1.80
LDA-8	2.00
LDA-9	3.95

DESIGN MATE SERIES

DM-1	$ 69.95
DM-2	74.95
DM-3	74.95
DM-4	129.95

DESIGN MATE CASES

DMC-1	$6.95
DMC-2	5.95

PRESCALER AND ACCESSORIES

PRESCALER	$59.95
100-CA1	9.95
100-CA2	9.95
100 CLA	3.95
PSA-1	2.95
PSA-2	5.95
PSA-3	3.95

MINI-MAX AND ACCESSORIES

MINI-MAX	$99.95
MMAC2	9.95
MMAC3	9.95
MMA4	3.95
MMC5	5.59
MM-IPC	3.95

MAX-100 AND ACCESSORIES

MAX 100	$134.95
100-CLA	3.95
100-CA1	9.95
100-CA2	9.95
100-IPC	5.95
100-MMA	3.95
100-LLC	14.95
100-CC	9.95

QT SOCKETS & BUS STRIPS

QT-59S	$10.00
QT-47S	8.00
QT-35S	6.00
QT-18S	4.00
QT-12S	3.00
QT- 8S	2.50
QT- 7S	2.25
QT-59B	2.25
QT-47B	2.00
QT-35B	1.75

EXPERIMENTOR SOCKETS

EXP-300	$ 9.95
EXP-350	5.50
EXP-325	2.75
EXP-600	10.95
EXP-650	6.25
EXP- 48	4.00

PROTO BOARDS

PB-6	$ 15.95
PB-100	19.95
PB-101	22.95
PB-102	26.95
PB-103	44.95
PB-104	54.95
PB-203	75.00
PB-203A	124.95

PROTO-CLIPS/PACKED CARDS

PC-14	$ 4.50
PC-16	4.75
PC-24	8.50
PC-40	13.75

PROTO-CLIPS WITH CABLES

Cable Length Inches	Single Clip Price (S)	Double Clip Price (D)
PC 14-18	$ 7.75	$14.75
PC 14-36	8.50	15.50
PC 16-18	8.50	16.00
PC 16-36	9.25	16.75
PC 24-18	12.25	25.25
PC 24-36	13.00	26.00
PC 40-18	21.00	42.00
PC 40-36	21.75	42.75

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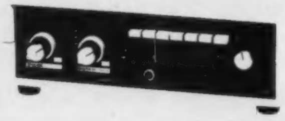
CSC breaks the professional instrument price barrier!

ONLY CSC COULD PROVIDE SUCH AN UNUSUAL VALUE: A SET OF MATCHED, PROFESSIONAL-GRADE GENERATORS, PERFECT FOR SHOP OR LABORATORY, YET PRICED FAR BELOW COMPARABLE UNITS.

NEW!

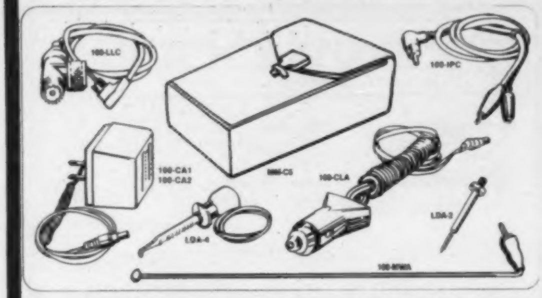
DIGITAL PULSE GENERATOR 4001

$235.00



- 0.5Hz-5MHz Frequency range
- 100mV-10V positive output; less than 30 nanosecond rise/fall times
- Independent TTL-compatible output (rise-fall times less than 25 nsec.)
- Square wave output mode
- Compliment (polarity inverted) output
- Independent pulse width and spacing controls
- 10⁷:1 duty cycle range
- Continuous and manual one-shot operation
- External triggering, DC to 10MHz
- Synchronous output gating

ACCESSORIES



ACCESSORIES ADD EVEN GREATER FLEXIBILITY TO CSC INSTRUMENTS . . . ECONOMICALLY!

PRODUCT	STOCK NO.	DESCRIPTION
Max-100:		
100-IPC	11-0006	input cable with allig. clip
100-CA1	11-0004	AC charger/adapter-110VAC, 50/60 Hz
100-CA2	11-0005	AC charger/adapter-220VAC, 50/60 Hz
100-MWA	11-0007	mini-whip antenna when direct coupling is impractical
100-CLA	11-0003	Auto cigarette lighter/adapter
100-LLC	11-0008	in-line tap for monitoring transmission line, rated >4 watts
100-CC	11-0002	vinyl carrying case
Max-50:		
MM-IPC	11-0021	input cable with allig. clip
MMAC2	11-0022	AC adapter - 110VAC, 50/60 Hz
MMAC3	11-0023	AC adapter - 220VAC, 50/60 Hz
MMA4	11-0024	mini-antenna, when direct coupling is impractical
MMC5	11-0029	hard leather carrying case
PS-500:		
PSA-1	11-0016	input power cable with allig. clip
PSA-2	11-0027	3' BNC to BNC cable
PSA-3	11-0028	18" phono to phono cable, (Max-100 to Prescaler)
PSA-4	11-0030	18" phono to mini-phone cable (Max-50 to Prescaler)
100-CA1	11-0004	AC charger/adapter 110VAC, 50/60 Hz
PS-500 (cont'd):		
100-CA2	11-0005	AC charger/adapter 220VAC, 50/60 Hz
100-CLA	11-0003	auto cigarette light adapter
Max-550:		
M1-IPC	11-0031	3' min.RF to min.RF cable
M2-IPC	11-0032	min.RF jack to BNC adapter
MM-IPC	11-0021	input cable with alligator clips (<50 MHz)
MMAC2	11-0022	AC adapter - 110VAC, 50/60 Hz
MMAC3	11-0023	AC adapter - 220VAC, 50/60 Hz
MMC6	11-0029	hard leather carrying case
Probes/Pulser:		
LDA-1	11-0009	1.5" probe tip
LDA-2	11-0010	2.5" long probe tip
LDA-3	11-0011	3" mini-hook to use (in place of probe tip)
LDA-4	11-0012	3" ground wire with mini-hook
LDA-5	11-0013	3" ground wire with allig. clip
LDA-6	11-0014	tip adapter, converts probe tip to mini-hook
LDA-7	11-0015	banana plug adapter to use in place of probe tip
LDA-8	11-0019	36" power cord with allig. clips
LDA-9	11-0020	36" power cord with mini-hooks
LDA-A	11-0018	all accessories except LDA-1 and LDA-8

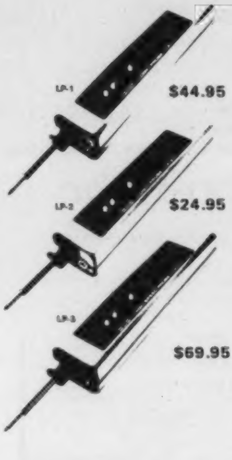
The CSC Model 3001 Digital Capacitance Meter

$275.00

More Accuracy. More capabilities. More versatility.

The CSC Model 3001 Digital Capacitance Meter is a high-precision 3½-digit instrument designed for measuring, testing, selecting and matching capacitance. But here its resemblance to other cap meters ends. Because the 3001 is the first *professional, benchtop instrument* designed for high-volume, heavy-duty tasks in production and quality control, as well as critical applications in laboratories and servicing.

LOGIC PROBES: HIGH-PRECISION, STIMULUS-RESPONSE, CIRCUIT-POWERED DIGITAL TESTING.



$44.95

$24.95

$69.95

LP-1 MEMORY PROBE

With a guaranteed minimum detectable pulse width of 50 nanoseconds and a maximum input frequency of 10 MHz, this probe is an inexpensive workhorse for any shop, lab or traveling tool kit. It detects high-speed pulse trains or one-shot events and stores pulse or level transitions indefinitely, replacing separate level detectors, pulse stretchers, pulse detectors and pulse-memory devices. And, it's reverse-voltage protected to 36V, over-voltage protected to ±50V continuous.
Stock No: 07-0002

LP-2 ECONOMY PROBE

Same basic design as the LP-1, but for slower-speed circuits and without the memory capability. Handling a minimum pulse width of 300 nanoseconds, this 300 KΩ-input probe is the economical way to test circuits up to 1.5 MHz. Detecting pulse trains or single-shot events in TTL, DTL, HTL and CMOS circuits, it replaces a separate pulse detector, pulse stretcher and node state analyzer. The unit is over-voltage protected to ±50V continuous, and operates from 5 to 15 Vcc at 30mA max.
Stock No: 07-0003

LP-3 HIGH-SPEED MEMORY PROBE

All the features of the LP-1 PLUS high-speed capabilities that let this probe capture pulses as narrow as 10 nsec, monitoring pulse trains to 50 MHz. LP-3 offers the capability of a high quality memory scope at about 1/100th the cost, capturing one-shot or low-rep-rate events that are all but impossible to detect any other way. All, without the weight, bulk, inconvenience or power consumption of other methods. Over-voltage protected to ±50V continuous, reverse voltage to 36V, the unit simplifies testing, debugging and servicing with capabilities not available in other instruments.
Stock No: 07-0004

LABORATORY PRECISION. VERSATILE AND RUGGED, FOR USE IN THE FIELD.

Faster . . . easier . . . and more economical digital testing: CSC Logic Probes were developed to meet the increased need for portable, compact *logic-state-oriented* test equipment. These precision, pocket-sized instruments instantly locate and analyze problems at the integrated-circuit level, allowing you to:

- Determine the logic state of any node—high, low, invalid
- Catch fast pulses and store them, if desired
- Find low-rep-rate glitches—impossible to detect, even with a fast scope
- Trace signals through circuits
- Check levels, pulse transitions, duty cycles . . . and more

- Simply connect the clip leads to the test circuit's power supply, set the Logic Family switch and touch the probe's tip to the node in question.
- Dual level indicator LED's, fed by precision window comparators, display HI (Logic "1"), LO (Logic "0") . . . tracing pulses through TTL/DTL or CMOS/HTL/HiNIL/MOS logic circuits.
- Depending upon the setting of the PULSE/MEMORY Switch, a third LED stretches pulse transitions or latches on first transition, for easy "tracking" of "0" and "1" states up to 50 MHz. Unlike other designs, CSC Logic Probes respond to *both positive and negative level* transitions.
- When high frequency signals are unsymmetrical, and duty cycle is less than 30%, LO LED lights; while duty cycles above 70% light the HI LED.

NOW, LABORATORY-QUALITY PULSE AND FUNCTION GENERATORS THAT SET NEW STANDARDS IN ECONOMY WITHOUT SACRIFICING PERFORMANCE.

NEW!

FUNCTION GENERATOR 2001

- Sine-, square-, triangle- and separate TTL square wave output
- Frequency range: 1Hz-100KHz
- Frequency Sweepable over 100:1 range
- Pushbutton range, function and DC offset selection
- Low distortion
- Variable output to 10V P-P
- Shortproof outputs

$186.00

$165.00

NEW!

MAX-550: POCKET-SIZED 1 KHz-550 MHz COUNTER.

A wide-range frequency measuring instrument in a calculator-sized case.

- Measures 1000 Hz to 550 MHz, guaranteed
- No larger than a pocket calculator
- Full 6-digit display with Lead-Zero blanking
- Crystal timebase accurate to 3 ppm
- Compact, rugged low-drain design
- Choice of two power sources

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KENWOOD

TR7600: 2m FM XCVR. 10 watts, LED readout, 144–147.995. Fully synthesized, *any* repeater offset possible, memory channel.

TR7600 VHF XCVR	$375.00
BLC 10/70 VHF Power Amplifier	149.95
TOTAL REGULAR PRICE	$524.95
SALE PRICE	$424.95

Vhf engineering

SAVE $100.00

Unarco-Rohn

COMPLETE 25G TOWER PACKAGES

50' Guyed Tower: Includes top section, 4 regular sections, base plate, rotor plate, 50' guy wire, 2 guy assemblies with torque bars, 3 concrete guy anchors and other miscellaneous hardware.

TOTAL REGULAR PRICE	$594.02
SALE PRICE	464.02

SAVE $130.00

50' Bracketed Tower: Includes top section, 4 regular sections, base plate, rotor plate and universal house bracket.

TOTAL REGULAR PRICE	$366.15
SALE PRICE	266.15

SAVE $100.00

BECKMAN

If you've ever been troubled by a faulty multimeter — or had one that wasn't quite up to the tougher jobs — your troubles are over

Choice of Models

The TECH 310 has all above features, 7 functions, 29 ranges, plus 0.25% Vdc accuracy

The TECH 300 has a 0.5% Vdc accuracy and all the above features, but without Insta-Ohms™ continuity function or the 10 amp current ranges

Complete Multimeter Capability

DC volts	100μV to 1500V
AC volts	100μV to 1000V rms
Resistance	0.1Ω to 20MΩ
DC current	100nA to 10A (TECH 310) 100nA to 2A (TECH 300)
AC current	100nA to 10A (TECH 310) 100nA to 2A (TECH 300)

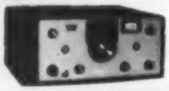
Diode/Semiconductor test function

Continuity function (TECH 310)

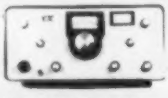
TECH 300 – $110
TECH 310 – $140

TEN-TEC

NOVICE SPECIAL



574



570

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Purchase your Century 21 (570 or 574) from us and have up to one year to apply the full purchase price towards a new HF transceiver when you upgrade your station.

TEMPO KLM YAESU

Syncom S1 with TTP: From Tempo — the world's first synthesized 800 channel handheld transceiver. Includes battery pack, charger, telescoping antenna — and 800 channels!

FT207R: From YAESU — 2m FM XCVR. Handheld completely synthesized, digital readout, keyboard access, 2 watts, 4 memories and much more.

KLM PA2-25B Power Amplifier: 2 watts in, 25 watts out.

PACKAGE 1

Tempo S1 w/TTP	$339.00
KLM PA2-25B Power Amplifier	92.95
Total Regular Price	$431.95
SALE PRICE	$396.95

SAVE $35.00

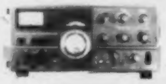
PACKAGE 2

FT207R Synthesized 2m handheld	$399.00
KLM PA2-25B Power Amplifier	92.95
Total Regular Price	$491.95
SALE PRICE	$441.95

SAVE $50.00

KENWOOD

...pacesetter in amateur radio



TS520SE

TS520SE: 160–10 meters, 200 watts P.E.P., speech processor, noise blanker, excellent sensitivity and minimum cross-mod.

5BTV

TS520SE	$629.95
Hustler 5BTV Vertical	139.95
TOTAL REGULAR PRICE	$769.90
SALE PRICE	$649.90

SAVE $120.00

or

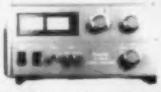
ATB34

TS520SE	$629.95
ATB34 Cushcraft TriBander	$329.95
TOTAL REGULAR PRICE	$959.90
SALE PRICE	$793.90

cushcraft

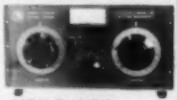
SAVE $166.00

KENWOOD



TL922A: 2kW P.E.P., 160–15 meters, 3-500Z tubes.

Model 43



MBII TUNER: 3kW, 160–10 meters.

TL922A:	$1199.00
MBII Tuner	295.00
Total Regular Price	$1494.00
Sale Price	$1294.00

SAVE $200.00

TL922A:	$1199.00
Bird Model 43 with 2500H element and carrying case	201.00
Total Regular Price	$1400.00
Sale Price	$1200.00

SAVE $200.00

CALL AND CHECK OUR GREAT DEALS ON ALL YOUR AMATEUR RADIO NEEDS.
DIAL: 1-617-391-3200
Stock items shipped within 24 hours. Prices subject to change.
Limited quantity on some items.

TEL. 1-617-391-3200

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Prices FOB Medford, Mass. Mass. residents add 5% sales tax.
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5% Sales Tax (Mass. Residents)	
Shipping and Handling	$3.50 Min.
Amount Enclosed	

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☐ Check Enclosed ☐ Visa ☐ Master Charge ☐ $1 Enclosed for Catalog ($1 refundable with first purchase)

PRICES SUBJECT TO CHANGE WITHOUT NOTICE

Card no. ______________________ Card exp. date __________
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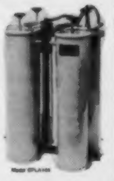
SPECIAL PRICING NOTICE

Many of the major items, such as transceivers, are availalbe at special discount prices. A complete list of these special discount prices may be obtained by writing or calling our mail order department. If your order contains one of the items on the current discount list our sales staff will make sure that you receive the lower prices.

BANDPASS-REJECT DUPLEXER DPLA-144 FOR 144-174 MHz

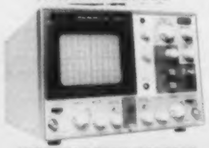
Also available for 54, 220, 450 MHz.

WACOM $479



These Band Pass Band Reject Circuit duplexers include the use of an exclusive circuit developed for WACOM, which provides superior suppression of spurious sideband noise between and adjacent to the duplex frequencies. When used with a high Q filter, the Band Pass Band Reject Circuit provides frequency response curves with bandpass cavity characteristics at the frequency to be passed and band-reject cavity characteristics at the frequency to be attenuated.

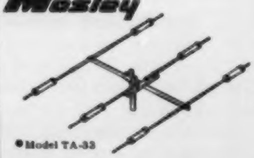
SPECIAL! 15% OFF ALL HITACHI SCOPES



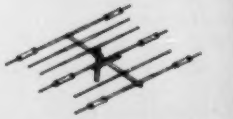
HITACHI OSCILLOSCOPES

Single and dual trace, 15 and 30 MHz. All four high sensitivity Hitachi oscilloscopes are built to demanding Hitachi quality standards and are backed by a 2-year warranty. They're able to measure signals as low as 1mV/division (with X5 vertical magnifier). It's a specification you won't find on any other 15 or 30 MHz scope. Plus: Z-axis modulation, trace rotation, front panel X Y operation for all four scope models, and X10 sweep magnification. And, both 30 MHz oscilloscopes offer internal signal delay lines.

- V-302 30 MHz Dual Trace $850.50
- V-301 30 MHz Single Trace $670.50
- V-152 15 MHz Dual Trace $625.25
- V-151 15 MHz Single Trace $490.5
Mosley



● Model TA-33



- ● Model TA-33, 3 elements, 10.1 dB forward gain (over isotropic source) – $264.00
- ● Model TA-33 Jr., 3 elements, 10.1 dB forward gain (over isotropic source) – $197.00
- ● Model MPK-3, 7500 Watts AM/CW and 2000 Watts P.E.P. SSB – $67.75
- ● Model TA-36, 6 elements – $392.75
- ● AK-60 mast plate adapter – $14.50
- ● Model CL-33, 3 elements – $304.75
- ● Model CL-36, 6 elements – $392.75
- ● Model CL-203, 3 elements – $290.00
- ● Model TA-40 KR – 40 meter conversion kit – $119.50

SPECIAL! 25% OFF ALL MOSLEY ANTENNAS.

DEPARTMENT STORE TUFTS

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Contests

from page 25

GMT, band, and emission. Logs must be received not later than September 13th. The first contact for each claimed multiplier must be indicated and numbered and a checklist of contacts and multipliers should be included. Multi-operator stations should be noted and calls of participating operators listed. Logs and comments should be sent to: Englewood Amateur Radio Assoc., Inc., Post Office Box 528, Englewood, New Jersey 07631.

A #10 size SASE should be included for results. Stations planning active participation in NJ are requested to advise the EARA by August 2nd of their intentions so that they can plan for full coverage from all counties. Portable and mobile operation is encouraged.

RHODE ISLAND QSO PARTY

1700 GMT August 16 to
0500 GMT August 17
1300 GMT August 17 to
0100 GMT August 18

Sponsored by the East Bay Amateur Wireless Association. RI stations work other RI stations and the rest of the world. Others work RI stations only. The same station may be worked once per band and mode. RI Novice and Technicians sign with /N or /T to designate license class.

EXCHANGE:

Send RS(T) and state, province, country, or RI county. Members of East Bay AWA will also identify themselves with "MEMBER."

FREQUENCIES:

Phone—3900, 7260, 14300, 21360, 28600, 50.110, 144.2.

CW—1810, 3550, 3710, 7050, 7110, 14050, 21050, 21110, 28050, 28110.

Use of FM simplex is encouraged, but no repeaters are allowed.

SCORING:

RI stations score 2 points per QSO, RI Novice and Technician stations score 5 points per QSO. Multiply total QSO points by the number of RI counties, states, provinces, and DX countries worked.

Others score 2 points per RI QSO and 5 points per QSO with RI Novice or Technician. Multiply total QSO points by the number of RI counties worked (5 maximum: Bristol, Kent, Newport, Providence, and Washington).

All stations score an additional 5 points for each QSO with a member of the East Bay AWA.

AWARDS:

Certificates will be awarded to the top-scoring station in each RI county, state, province, and DX country; the top-scoring Novice and Technician station in each RI county and state; and the ARC in each state, province, and DX country that submits the highest aggregate score with a minimum of 3 logs per club.

ENTRIES:

Logs must show date/time in GMT, call exchange, band, and mode. On a separate sheet show name, call, mailing address, club affiliation (if any), total QSO points, multiplier claimed, and final score. Entries must be postmarked no later than September 15th. Send logs and summary to: East Bay Amateur Wireless Assoc., PO Box 392, Warren RI 02885. Include an SASE for a copy of the results.

ALL ASIAN CW CONTEST

Starts: 0000 GMT August 23
Ends: 2400 GMT August 24

The purpose of this contest is to enhance the activity of radio amateurs in Asia and to establish as many contacts as possible during the contest periods between Asian and non-Asian stations. Please note the contest periods have been extended, scoring methods have been changed, and awards have been added for US stations.

Entry classifications include single-operator/single-band (160-10 meters), single-operator/multi-band, and multi-operator/multi-band. For single-operator classes, never transmit two signals or more at the same time. Only one signal at all times should be used. For multi-operator entries, never transmit two signals or more on each band at the same time. Only one signal per band should be used. In all classes, no crossband contacts are allowed.

EXCHANGE:

OM stations send RS(T) plus two numbers representing operator's age. YLs send RS(T) plus "00."

SCORING:

Non-Asian stations score 3 points per Asian QSO on 160 meters, 2 points on 80 meters, and 1 point on all other bands. The multiplier is the number of different Asian prefixes worked on each band, according to the WPX rules. Please note that JD1 stations on Ogasawara (Bonin and Volcano) Islands belong to Asia. JD1 stations on Minami Torishima (Marcus) Island belong to Oceania. Do not count US military radio stations in the Far East (KA) as being in Asia.

Asian stations use same contact scoring, but for contacts with non-Asian stations. The multiplier is the number of different countries worked on each band according to the DXCC countries list.

The sum of the contact points on each band times the sum of the multipliers on each band will give the final score.

ENTRIES & AWARDS:

Contest rules recommend using a summary and log sheet format similar to those shown on page 21 of the June, 1980, *73*. Please use separate sheets for each band and keep all times in GMT. Show each multiplier only the first time on each band. Both logs and summary sheets must arrive in JARL, PO Box 377, Tokyo, Japan, on or before November 30th. Entries can be disqualified for violation of the contest rules, false statements in the report, or taking points from duplicate contacts on the same band in excess of 2% of the total.

Certificates will be awarded to those having the highest score in each entry in proportion to the number of participants from each country and also those from each call area in the United States. Only highest score if 10 or less entries, second place if 11 to 20 entries, third place if 21 to 30 entries, fourth and fifth places if 31 or more entries. In addition, the highest score in each continent of the single-operator/multiband and multi-operator/multiband entries will receive a medal and certificate from the Minister of Posts and Telecommunications of Japan.

WORKED ALL BRITAIN CONTEST—VHF

Starts: 0900 GMT August 31
Ends: 2100 GMT August 31

This is the last of the five Worked All Britain contests for this year.

All contacts must be made on the VHF bands above 30 MHz. Operating classes include: single- or multi-operator, single- or multi-band, and SWL. In the case of multi-operator, only one transmitter may be used at any time. There is a special section for mobile operators.

EXCHANGE:

RST, QSO number from 001, WAB area and county. Book numbers and districts may be requested but are not mandatory as part of the exchange.

SCORING:

Score 5 points for each completed QSO. Stations may be worked on other bands for extra points.

Multipliers for UK contestants are each WAB area and each overseas country (DXCC list). In addition, Alderney, Guernsey, Jersey, and Sark count as separate countries. The remainder of G, GD, GI, GM, and GW count as one multiplier only.

Multipliers for overseas contestants are each WAB area, county, and each G prefix (G, GD, GI, GM, and GW). Multipliers count on each band, i.e., a station worked on three bands = 3 multipliers.

For mobile entries, every contact made from a different area will count five points, but the multiplier counts once only (e.g., mobile station X from ten different areas—score is 10 times 5 points, but only one multiplier for the mobile station).

AWARDS:

Certificates for the leading contestant in each class or entry. For awards, each G prefix is separate. There will also be certificates issued to the leading contestants from each DXCC country and also to SWLs. Certificates for 2nd and 3rd will be issued if there are 10 or 25 entries from a particular country or call area.

ENTRIES:

Logs must show the TITLE of the contest, name and full postal address of contestant, QSO details, total points claimed, multipliers claimed, and the full details of all operators when multi-operator entry is submitted. Logs must be sent to the contest manager: R. L. Senter G4BFY, 27 Station Road, Thurnby, Leicester LE7 9PW, England.

Entries must be postmarked

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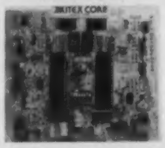

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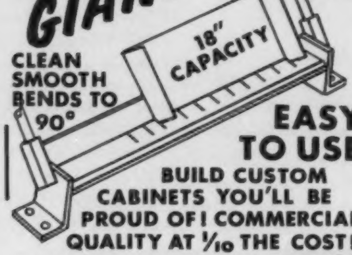

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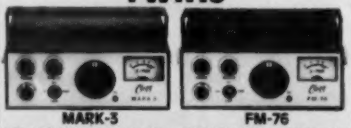

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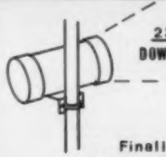

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not later than one calendar month following the date of the contest and must be received by the contest manager not later than 40 days following the said contest. A signed declaration that the station was operated in accordance with the current licensing conditions must accompany all entries. It is a condition of entry that the decision of the WAB Contest Manager and the WAB Committee shall be absolute in the case of dispute. For SWLs, all stations logged must be participating in the contest and giving serial numbers which must be logged. The results will be reported to the RSGB and the Contest Manager will supply a detailed result sheet on receipt of an SAE on or after November 1st.

KA8COI

Amateur station KA8COI will be operating as a special event station this Labor Day, September 1, 1980, during the course of the annual Muscular Dystrophy Telethon hosted by Jerry Lewis. The time will be from 0330 to 2230 GMT and the frequency will be 7.230 MHz SSB. A numbered certificate will be available to all stations making contact with KA8COI during this period. There will be no charge or fee for the certificate. Stations are requested to send an SASE with their QSL and mention their QSO number (which will be given them on the air). No third-party traffic will be handled on the behalf of the Muscular Dystrophy Association and no solicitations for donations will be made over the air. Anyone wishing to donate to the MDA is urged to do so through their local telethon station. The MDA is a non-profit charity; donations would be tax-deductible.

The Muscular Dystrophy Association has been contacted about this operation and has issued their formal approval. The certificate will bear the signature of Jerry Lewis, National Chairman for the MDA. Send QSL information, QSO number, and SASE to: KA8COI—MDA Certificate, PO Box 332, South Webster OH 45682.

DX

from page 16

ly CW by Eric, as neither of these countries is particularly rare if one works all modes. QSLs for all SM0AGD operations to SM3CXS.

N6DX, N2KK, and JA1BK finished their Pacific Islands operating in May at A35DX, Tonga, canceling the planned last stop at Wallis Island. Reports would indicate that much if not most of the operating by this group was on 6 meters.

Jurgen Carow DF3OL and nine other German hams spent two weeks in Sri Lanka teaching radio. Jurgen made 575 CW contacts while he was there using 4S7OL. QSL to W0JRN, *Callbook* address.

More Germans, this time members of the Wiesbaden Amateur Radio Club, vacationed in Leichtenstein and operated DA1WA/HB0. North Americans send cards to Steven Hutchins, Box 4573, APO NY 09109. You may have seen the special on Leichtenstein on CBS's "60 Minutes" recently; much of their economy is postage stamps sold to collectors around the world. Unfortunately, the millions they had printed for the Olympics were destroyed in May.

K6LPL/KH3
APRIL, 1980

The trip to Johnston Island was initially planned in February, 1980, when it became obvious that activity from KH3, especially on single sideband, was very low. There was great difficulty in securing permission to land on the island due to long-standing military policy, but with the help of Joe Merdler N6AHU and Congressman James Corman, the military was persuaded that I was not a "dangerous, radical type."

Once permission was secured from the Defense Nuclear Agency, they became extremely cooperative and anxious to ensure the success of the trip.

I arrived by Air Micronesia on April 21, 1980, at 1100 local time (2100Z). After 30 minutes of indoctrination in the use of gas masks, I was shown the MARS station. The layout was quite nice, but the equipment was badly in need of alignment and maintenance.

I brought a Kenwood TS-520SE, 2 GLA 1000 amplifiers, OSCAR equipment, a complete Micrولog RTTY station, and various peripheral equipment for the use of the resident General class operator, KH3AA, and this equipment is to be left on the island for any future hams that may be stationed there. This equipment was donated by the Southern California DX Club and the Southern California DX Foundation.

There was an excellent antenna system already in place on the island, including 2 TA 36 beams at 60 ft., an 80-meter dipole at 70 ft., and a 2-element 40-meter beam at 65 ft., so no further antennas were needed.

After station set-up, the first CQ was called and the pileup was horrendous. Over 2,000 contacts were made in the first 18 hours. The pileups were orderly and well-behaved. Initially, I worked split on 10 and 15 meters, but as the first initial rush calmed down, it became obvious that working transceive by call districts resulted in a 20% higher QSO rate. This was made possible only by the excellent signal and good propagation conditions, and I would not recommend it under ordinary circumstances. The highest QSO rate was an unsustainable 5.8 per minute for stateside stations. The rate for JAs was approximately four per minute, and Europe was quite variable. The European hams were quite unruly and never seemed to follow instructions, even though they were repeated in six languages. The only general exceptions to this rule were the Scandinavian and Soviet stations who seemed to follow instructions fairly well. The number of QSOs continued at approximately 2,000 per day until the last 36 hours, when conditions deteriorated to the States, but the JAs picked up the slack. They are a pleasure to work with once you get used to their strange phonetics.

By the last day, I needed only Zone 26 for WAZ, and I got that with the help of W6PJX and W7PHO when I worked HS5AID.

I should say a word about propagation from this location. There were two excellent openings to Europe per day on both 10 and 15 meters. The initial 10-meter opening was in the early morning hours local time, and a secondary opening occurred at approximately 0700Z. The 15-meter openings were slightly later, beginning at about 1700Z and again at 0900Z. Signals were extremely loud to Europe on both bands on most occasions. On 20 meters, there was a morning opening to Northern Europe that was excellent, and an evening opening at approximately 0500 that was also good; however, the QRM was extensive. Excellent openings to A51, JT1, Southern Africa, the Indian Ocean, South America, etc., occurred at these times as well. During the evening opening at 0700Z, both long and short path to Europe were possible on 20 meters. 15 meters was the most reliable band by far, and approximately 60% of the QSOs were made on that band.

40-meter and 80-meter propagation was impeded by a tremendous amount of static crashes; however, 41 states were worked on 40 meters including all of the W1s, 2s, 3s, and 4s. The 80-meter opening was also good and the W1s were worked with no difficulty. No foreign stations other than JAs, VKs, ZLs, etc., were worked on 40 and 80 meters. There seemed to be persistent openings to JA, VK, ZS, etc., at all hours of the day and night.

All in all, it was a wonderful trip with 125 countries, Worked All Zones, and 12,180 QSOs.

Stand by for the next big one!—K6LPL.

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CI3LSS	VE3LSS
CK8MB	K0BJ
CN8CW	WA3HUP
CR9AK	VS6AG
CT2QN	W2KF
CX5RV	G5RV
WB8CSH/C6A	K8CW
DU1POP	JA3UB
KP4KK/DU2	WA3HUP
EA6GB	WB1DQC
EC9AA	EA1QF
EP2TY	JR3WRG
FG0AYS/FS	W2KN
FH0FLP	DK9KD
FH0FLR	DK9KD
FK8AU	I0PQR
FK8CR	W7OK
FK8DD	WB3JUK
FK8DJ	JH3XCU
FK8PQ	I0PQ
FK0BW	DJ5CQ
FM0FJE	F5VU
FO8DP	N7RO
FP8AQ	N2AMK
FR0ACB	DK9KD
FR0ACC	DK9KD
FR0FLO	F6CVI
HH2VP	N4XR
HI6XQL	YASME
HI8IARU	HI8LC
HK0BKX	WB4QFH
HL9KE	K4WSB
HL9TO	WB6GYS
HL9UG	N4CPR
HS1AMT	W2TK
HS4AMI	VE3DPB
HV3SJ	I0DUD
HW3ITU	F6BFH
HZ1AB	K8PYD
H5AA	ZS4MG
JW7FD	LA5NM
JY3ZH	DJ9ZB
J28CB	I8JN
J3AE	K1EM
J6LGK	WB4SXX
J6LGL	WB4SXX
J6LKY	N6NK
KA6WW	AJ6M
N4ADJ/KH2	WB4CCT
WA4BVB/KH2	WA4GLE
K6LPL/KH3	K6LPL
K6LPL/KH5	K6LPL
KC6HC	KG6JHH
KH6GKD	WB6UBX
KH0AC	K7ZA
KX6PP	WD4NVH
LA5YJ	WB1DQC
OD5LX	SM0GMG
P29DP	W7OK
P29JA	WA7OPZ
P29NLB	WB2FLB
DJ1US/ST3	DF2RG
SV0AA/9	N2OO
SV0AT	AF4B
S79CP	KA2AKE
S79GM	WA4JIL
S79MC	N4NW
TG9ML	K5BDX
TG9XGV	K4CLA
W5TIY/TI2	N5IQ
TI2AV	W2MIG
TI9CC	TI2CF
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TN8AJ	WB9TTM
TU2DP	N4BZV
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TU2HS	DJ9HD
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TU2IN	K3HBP
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VK0KH	VK5WV
VP1HE	DL1JW
VP2AZG	WB4SXX
VP2KAH	YASME
VP2KAJ	WB8LDH
VP2MDG	W6FDG
VP2MFC	K1ZZ
VP2MFJ	K1RIF
VP2MOC	W2KF
VP2SK	W8PSD
VP2VEZ	W5HF
VP2VFT	K1IJU
VP2VGB	K7SE
VP2VGF	WA1GXE
VP8WA	WA4JQS
VQ9DM	K1BZ
VQ9TT	KB5MZ
VQ9WE	WA6IJZ
VR1PE	WB6UBX
VS5KV	N2OO
VS5OO	N2OO
VU2LQA	W2YTO
XT2AU	WA1ZEZ
XT2AW	KN1DPS
YA1OS	SM0DJZ
YB9ADA	W5SVN
YB0ACL	W4QQ
YB0PG	WA2DWE
YC1BZ	JA0YJA
ZK1BD	ZL1SZ
ZK1CD	AD1S
ZK2DD	VE3FRA
ZK2DX	JA1BK
ZM7AA	4Z4TT
ZP5GLS	W3HNK
3B6CD	3B8CF
3B9DX	3B8DX
3D2DB	JA1BK
SM0AGD/3D6	SM3CXS
4S7DX	WB2VFT
4S7OL	W0JRN
5B4EZ	OE1EPW
DF5FM/5N0	DF3FN
5N0DOG	W4FRU
5U7BE	DK2OC
5Z4NG	DK9KH
5Z4QS	N1NA
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9H1BR	WA2MFV
9H3AK	DL1SV
9K2DX	W6LV
9K2EP	SM0DJZ
9M6MU	N2CW
9N1MM	N7EB
9Q5GB	W7KTI
9VITK	JA6RIL
9VITX	N5FN

QSL Managers—Lists of QSLing information are available everywhere, and we do mean everywhere. We have tried to make this list useful in a special way by listing stations actively worked on the bands during the month of May. This is a regular part of this DX *column in 73. You will note some listings which are the same as they have been for years. The idea is to provide you with useful information for your recent DXing.*

Last stop in May for John Ackley KP2A was at the home of Father Marshall Moran 9N1MM, in the Himalayan mountains of Nepal. John's first morning there (evening in the US) was May 22, when band conditions were outstanding, if not phenomenal. He was as loud on 15 meters as the woodpecker! John's Nepal visit followed operating at 8Q7 Maldives, VS5 Brunei, HS Thailand, and preceded his final stop at CR9 Macao in early June. All sponsored in part by the International DX Foundation.

Several operations took place from Cocos Island, with a virtual flotilla of boats from Costa Rica arriving with hams nearly every weekend. TI9CF, TI9XXX, TI9FAG, TI9PN, and TI9CC were all heard. Their favorite haunt appeared to be the low end of the 20-meter phone band (14200-210) in the early evening hours.

Operations which did not take place included the YV0 Aves Island operation, originally scheduled for the *CQ* WPX Phone Contest in April, postponed once, then cancelled. It was rumored they arrived by boat at the wrong Aves Island, there being two near Venezuela. VE3FXT did *not* come on from Burma, the rumored Bajo Nuevo activity in late May did *not* happen, and *none* of the China callsigns heard on the bands were anything but bogus. A "CE0ZJ" on Juan Fernandez was worked by many in April and May but is disowned by the Chilean government authorities. And ZS2MI on the bands is a figment of your (or someone's) imagination after June 10; Johann left then and his replacement on Marion Island is not a ham.

QSL cards out in quantity in May gladdened DXers' hearts: 3C1AA, 3C0AB, TZ4AQS, TN8AJ, 8Q7AL, and more. Glorioso cards are supposed to have come out in early July, as are WA2FIJ/Kingman Reef confirmations. The accompanying list of managers for May actives should help you get what *you* need. KL7IRT was notified by the post office that a bundle of QSLs headed for the ARRL outgoing bureau in Newington was lost without a trace. These were for Europeans and Japanese worked during the 1979 *CQ* WPX Phone Contest. ET3PG cards can be most easily obtained by ensuring you ask the operator for *his* full name and his PO Box in Addis Ababa; each station operator handles his own confirmations separately.

Jim Smith P29JS reports further progress in arrangements for an operation from VK0 Heard Island late this year or early in 1981 (see letter in this column last month). Finances will be considered; the boat ride is ten days each way and Smith envisions a 14-day stay on Heard. We are encouraged by his admonition of "two contacts only per station, one phone and one CW." Now that's planning.

TN8AJ continues active from the Congo Republic when circumstances permit. One of those circumstances is the availability of electric power. Approval for sending his card for DXCC credit was finally obtained from Newington in late May. WB9TTM handles the cards *only* for when he has handled a list operation for TN8AJ; otherwise, the cards come from DM2XLO.

TL8WH, at an embassy in Bangui, Central African Republic, expects to be stationed there at least two years. He is primarily active on 20-meter SSB. W5RU is the QSL address.

VK3OT's Christmas Island VK9XT operation in March, 1980, netted 15,000 HF contacts in 150 countries, plus 1700 6-meter contacts with eleven Asian countries. Steve has answered over 5000 direct QSLs plus another 3000 via bureaus. Steve also operated VK2ATZ Lord Howe in the 1979 *CQ* WW Phone Contest for 10,000 contacts, but has been surprised to receive only about 3000 cards for that one.

Dave Gardner K6LPL received the Southern California DX Club's annual "DXer of the Year" award at the Fresno DX Convention in April. Dave became a ham-shack/household name in January as part of the K6LPL/KH5 operation from Palmyra and clinched it by making over 12,000 contacts singlehandedly from Johnston Island in April. The story in his own words accompanies this column.

Hugh Cassidy WA6AUD, publisher of the *West Coast DX Bulletin* from 1968 to 1979, was inducted into the *CQ* DX Hall of Fame in April, also at the Fresno Convention. Cass and his wife Virginia put out the bulletin every week by themselves without a miss for over 600 issues.

All of the information for this column came from *The DX Bulletin*, a weekly publication out of Vernon CT. Please send your photos and comments to the editor at the above address. Thanks to SM6AFH and K1RIF for the photos this month.

W2NSD/1 NEVER SAY DIE

editorial by Wayne Green

from page 6

is no way in the world for mankind to do without this important way of life.

I pointed out that it was a Frenchman who had the concept and got things started towards the European Economic Community and that the logical extension of this concept was one Europe, with a common language, common money, and a single government. This had worked out well in the United States, I mentioned, with the best parts of each culture being preserved.

With the communications and travel systems we have now, resistances toward a world melting pot concept will only slow the eventual process, not prevent it. It is just too simple for me to travel to the Netherlands, bringing my little envelope of English with me and thus chilling, to some degree, the use of the Dutch language. Our exported movies and television programs put even more of a chill on resistances to English. I sat in Delft, spending a good part of an evening watching a special program on television. They were playing a full day of American TV so the Dutch could see what it was like. I have never bothered to watch "The Ropers" at home, but in Delft I watched them and enjoyed them. Ditto a Sinatra special which went on into the early morning hours.

Next, the scene shifts to home and a segment on "60 Minutes," I think. It was recorded while I was away and had to do with the gradual change of the US to a bilingual nation. Spanish is slowly being accepted as a second language in our country. The pressure is on from the millions of Mexicans who have come to our country . . . from the Puerto Ricans, who have come here to escape the poverty of their country . . . and the hundreds of thousands of Cubans seeking to get away from Castro.

One of the things which has helped to make America strong has been the melting pot syndrome and I think we should all fight to keep that going for us. I don't know if you know this or not, but English used to be the official language in Puerto Rico. That got changed some thirty years ago as a result of a visit there by Eleanor Roosevelt . . . who put the pressure on to get it changed to Spanish . . . with obvious success. That is what I was told when I first visited that country, back in 1955. They had been having problems at that time with the Spanish speaking people getting into fights with the Americanos . . . stoning our military buses.

English is the most common language in the world and I think we should keep the pressures on to make it the world language. I think we should do this particularly at home, pushing back the tide of signs in Spanish and French which are infiltrating our society.

The common language of amateur radio worldwide is English. Indeed, thousands of people learn English through their interest in amateur radio and their contact with the almost universal English speaking community we have on our DX bands.

But if we acquiesce to the pressures to let children who are being brought up in this country stick to their non-English tongues, we will be starting to unravel the melting pot concept which made our country so strong and into such a single society. Sure, it is more difficult on children who hear nothing but Spanish at home to learn English and deal with it in their schoolwork. But we've been through that for quite a few generations as the Germans arrived in large numbers, the French, the Polish, the Irish, and so forth. The first generation was the most difficult for them, the second had very little problems, and by the third generation the melting had been completed. But suppose we had arranged for whole towns to speak German in Minnesota and other towns to speak Swedish in Wisconsin, Spanish in Texas, French in Louisiana, and so forth? Out in Pennsylvania they would be talking Dutch . . . and it would be a mess.

WHERE IS HALLICRAFTERS NOW?

A recent article in the *Miami Herald* welcomed Hallicrafters to Miami. It is just getting started there, with about 120 employees at present making products for the telephone field.

In the 1930s through 1950s, Hallicrafters was the number one firm in the world in communications receivers. Few hams did not cut their teeth on a Hallicrafters receiver during this period. Many of their WWII SX-28 receivers are still in use in the backwaters of the world.

What happened to Hallicrafters? Well, they were doing fine until the early 1960s, despite a growing number of disappointing receivers being produced. This slippage in quality had a lot to do with the design philosophies of the Halligan family, where new sets would emerge from the advertising department and then engineering would have to do the best they could to live up to the ad claims and the pictures of the dummy sets appearing in the ads. Hammarlund and several other firms began to take advantage of this weakness.

The big blow came when in 1964 amateur equipment sales dropped over 85%, responding to the ARRL petition to the FCC to take away most of the phone bands from most amateurs unless they passed a much stiffer ham exam and code test. The bottom dropped out and it was at this time that Hammarlund, National, Harvey Wells, and most of the other firms making ham equipment faded away.

Hallicrafters got a shot in the arm making military equipment for the Korean war and turned out more for the Vietnam war, but it was gone from its old preeminence in amateur radio and shortwave. They tried other approaches, but eventually were taken over by a CB firm in Dallas. As interest in CB died down, Hallicrafters was reduced to nothing much more than a name and the contents of a few packing crates.

One of the CB owners bought out the name and the assets, fired everyone still involved, and moved the works to Miami to start over. The assets were further reduced by three substantial thefts of the stuff shipped to Miami. Still, they are back in business and the name will continue.

The name flared into visibility a couple years ago when an employee of Hallicrafters wrote a letter to Baldwin complaining about the ARRL. The chap reported that the League response was to try to get him fired rather than answer the complaints. Later the chap reported that Baldwin had been successful and that he had indeed been fired as a result.

Hammarlund was a most successful producer of superb receivers for many years. The 1964 crunch hit them hard. Not long after they got caught by this sudden stop in sales, they were selling off their capacitors and parts. National responded to the stop in demand for receivers by putting their money in military contracts . . . and it didn't take much of a miscalculation in that field to put them into bankruptcy.

All three major firms had been weakened considerably by getting into the sideband field late. By 1957 I was trying, as the editor of one of the two ham magazines, to convince the management of these firms that sideband was going to completely replace AM. They wasted several years of valuable product development time, allowing Galaxy and Central Electronics to grow on sideband equipment. They were just really getting into sideband with strength when the 1964 blow came, not only finishing off Hallicrafters, National, and Hammarlund, but also doing in Zenith, Galaxy, Johnson, B&W, and everyone else. Only Drake, which was just getting started in the receiver field, survived the debacle. Their sales of TVI filters kept them going.

UFOS AGAIN

The lack of hard news seems to have thrown the world of UFOlogists on hard times. A few years ago there were several organizations which were actively following up on UFO reports and publishing monthly newsletters. The oldest and biggest of them, NICAP, seems to have disappeared, with reports that someone took over and took the money. I don't even see any current references to APRO, which took over as number one when NICAP began to go downhill. Now there is a MUFON in Texas, but their newsletter has little excitement in it.

I've been following the UFO news from the first, trying to fit reports together into some sort of pattern. We have had amateur radio UFO nets which were started and then faded away, but they have never accomplished anything of substance. Indeed, if I thought that amateur radio could help to throw some light on the subject, I'd be pushing for whatever I thought would help.

At one time it seemed like it might be possible to take advantage of UFO reports to alert teams ahead of them so a better effort could be made to investigate the phenomena. If people only had early warning, they might be able to get out telescopes, cameras, electrostatic sensors, and other equipment to help us learn more about UFOs. Amateur radio seemed like the best approach to such a warning system . . . but somehow ham nets never really clicked and nothing came of the idea.

After reading several thousand UFO reports and just about every book published on the subject, I began to suspect that there was more than accident involved in the lack of really substantial evidence that UFOs exist. With many reports telling of their instant appearance and disappearance, there was a strong suggestion that some sort of time travel might be involved. This would answer a lot of questions which otherwise involved impossible to accept data.

What other reasonable explanation for the cave paintings from 17,000 years ago which depict the same saucer-like objects which have been reported right on down through history? No civilization is going to make the same model travel unit for 17,000 years. But if anyone were to invent time travel, you can bet that teams would be going back to write an authentic history of our planet. We don't know the rules of time travel yet, although some recent theorizing about Einstein's equations has persuaded many scientists that time travel may one day be practical.

One of the main worries has to do with what happens if you go back through time and kill your own grandfather. What then? This either can't happen or else it is possible to change events . . . neither of which concepts can be grasped with any clarity. More likely is that time travelers have some rules which they damned well better follow if they are going to ever return to their starting point. If so, it may be that the rules will cover making changes in the past which could affect the future . . . such as leaving evidence behind of their visit (such as we have been looking for).

There are a lot of reports of fake government agents who have confiscated the better UFO pictures which have been taken. There are hundreds of reports of people who have met the UFO travelers, but the surprising thing is the almost total lack of consistency in their reports of what they were told. Of course, if time travelers have a need to create confusion so as not to change the future, this would explain it.

Once you remove the concept of time as a barrier in travel, you can go anywhere you want, so the prospect of some other civilization visiting our planet becomes not merely possible, but virtually inevitable. And once they arrive, they will surely want to check back over the history of the planet. This would hold for all visitors . . . which might help explain the variety of beings reported by contactees. Some short, some tall, some fat, some thin.

If this is an even close guess to what has been happening, our trying to get more accurate data on the UFOs would obviously be doomed to failure. Thus, even if we were able to get a ham net working to help gather more data on the UFOs, the end result would be nothing more substantial than we have at present . . . or else the future might be changed . . . or the time traveler might go pffft.

I do appreciate getting newspaper clippings of UFO reports, so keep 'em coming. And if there are any serious organizations in the field, I'd like to know about them, too. In the meanwhile, I'll keep enjoying the swamp gas and plasma explanations for UFOs.

6000 WORDS PER MINUTE?

One of the projects that I am working on with the microcomputer industry has to do with promoting the concept of electronic mail. A number of large firms are working on the project, but I think it will be possible for the microcomputer industry to pull an end run and beat out Ma Bell, ITT, and any other firms interested in cornering EM communications. And that should even include the post office.

If the microcomputer industry can come up with a slick system which will enable any microcomputer user to send messages to any other user, all automatically and via the telephone wires, I think we'll have a working service before even IBM can do anything about it.

The basic idea is to have a box which will plug into a microcomputer and also into the telephone lines. This would allow you to write a message via a word processing program, and then it would ask you for the phone number to which the message is to be sent. From there on it would be all automatic. The box would disconnect your telephone so you would not be able to pick it up and screw up the communications. It would then dial up the desired number . . . and keep at it every minute or so if the number is busy the first time around. When the connection is made, it would cause the telephone on the other end to be disconnected and turn on the receiving computer. Then it would send the message, along with a verifying system which would make sure the message was received correctly. Once the message was completed, it would disconnect . . . unless the other person pushed a hold button to hold the circuit for an immediate answer.

The incoming message would be stored on a disk and perhaps a light would indicate the presence of a message. Naturally it would be simple to have the receiving system automatically forward the message to any place you want, all automatically. This would enable you to have your "mail" delivered to you both at the office and at home. You might even be able to get it in your car, if you want.

Okay, how does this tie in with amateur radio? Well, remember that we are talking about sending the messages over phone lines . . . and the bandwidth of these lines is about the same as we are used to with amateur radio. Thus, any message system we can use over the phone lines we should be able to use with amateur radio.

The present standard for telephone computer communications is 300 baud, the same speed we are presently authorized to use for amateur radio. I think this is pitifully slow and I hope that many amateurs will join me in trying to get this lid taken off our restrictive ASCII rules. I've had word from some readers that there are systems presently in use which are sending ASCII over the phone lines at 9600 baud. Now that's more like it!

For those of you who are not sure how fast or slow 300 baud really is, let me decipher this term for you. A baud is a single bit of information per second. Our ASCII code normally has eight bits to send the character plus one start bit and two stop bits, for a total of eleven bits. Thus at 300 baud we would be sending about 27 characters per second. That's 1636 characters per minute. That translates into 272 words per minute . . . which is about the speed of a slow reader. Anyone with some speed reading training can whip along at double to four times that rate.

If they are able to send 9600 baud over phone lines, then we should have little trouble in shifting to 1200 baud for our ham communications . . . and without exceeding the bandwidths allotted for voice channels. That would give us a throughput of 1000 words per minute, which is more like it. There is no reason why an amateur should have to use a channel every second that he is in contact. At that speed, we could get our messages across quickly and have the channel open for others to use while we are reading and getting ready to respond.

Getting back to the electronic mail, I'm working in the direction of the 1200 baud standard at present. If it is really practical to step that up to 9600 baud, fine . . . that would be great. But we do want a system which will function over crummy phone lines and make it so a very high percentage of our calls are handled without error.

Now comes the crux of the idea. Studies of the words used for ordinary mail show that only 200 English words constitute over 80% of the words used. If you think about that for a moment, you'll see that we could set up a simple dictionary of 250 words and represent them by one byte of information. We could put this dictionary on a little ROM chip and greatly speed up communications by having our computer look up the byte to represent each word . . . transmit that byte of information and then the process would be reversed on the receiving end.

The next step is to set up a larger dictionary . . . perhaps 30,000 words . . . which would be represented by two bytes. We could have specialty dictionaries for certain interests and businesses for another thousand words. Words not in the dictionaries would be sent one character at a time via the usual ASCII.

The net gain of such a system would be to permit messages to be sent at an effective rate of about 6000 words per minute, even though the transmission speed is only 1200 baud.

Once we have such a system working for electronic mail use with microcomputers, we could then use the same shorthand communications via amateur radio . . . over the shortwave bands, via satellites, and even through repeaters.

One interesting aspect of the system would be the ease with which it could be made confidential for business communications uses. By changing the bits around . . . a simple matter for a computer . . . the incoming messages would be almost impossible to decipher because the wrong words would be looked up in the dictionary ROMs.

Oh, and one other possibility . . . once you have your dictionary set up in a ROM, it would not be difficult to change these ROMs for translations into different languages. You could send English and have it come out in Arabic or Italian! You'd have to be careful of some slang phrases, which would translate oddly, but most of the messages would come through well enough. This would not hurt amateur communications at all . . . and would greatly increase interest in many foreign countries where our present dependence upon English is a problem.

If any amateurs are interested in getting started working with any parts of the ideas described here, you may be sure that *73* is interested in getting articles on the results of this work . . . the circuits evolved, etc.

MORE RADAR JAMMING

There have been some rumors of actual communications use of the 10.5-GHz rigs designed as radar jammers but marketed as ham transceivers as a stratagem to avoid FCC censure. If anyone has had any success in legal use of these rigs, we'd like to get information on it.

Dave W4OXC sent me a copy of an article in *Law & Order* magazine (June, 1979) on a new system for generating radar jamming signals. In this one, a series of tiny antennas tuned to 10.5 GHz are attached to the ignition wires of the car and thus radiate powerful broadband signals at that frequency. The article points out that this also tends to make the use of your car radio and CB (also ham rigs) impossible. It's an interesting approach and probably within the law. I don't think there are any standards for maximum ignition noise radiation . . . otherwise, my Datsun 280Z would have been removed from production.

No one seems to have yet come up with a legal radar jammer which is better than the one we published by Sterling Olberg W1SNN in the 1976 Holiday issue of *73 Magazine*. You know, at the time the article came in I was so enthused by it that I contacted a manufacturer and interested him in making the unit. I couldn't see why they couldn't sell tens or even hundreds of thousands of smoke detector/nullifiers. Then I contacted Olberg and he said, no, he had another firm which was interested. I think it all died about then, so the world never benefited from the brilliant concept and Olberg lost out on maybe a million or more in royalties.

The idea was simple. The Olberg detector worked on the principle of using a tuned antenna horn, just like the kind smokey uses. This, being tuned to the frequency of the radar, reflects back a much stronger signal than the car. A second diode in the antenna, fed by an audio oscillator, modulates the reflected signal, returning it with the tone (and speed indication) of *your* choice.

Despite a continuing flow of laws from states trying to regulate radio reception, the FCC has so far remained steadfast in protecting the right of any citizen to tune to any frequency he pleases. The restriction is that most radio signals may not be used for personal gain. This is contrary to the laws of states trying to restrict the use of scanners which will receive police signals or outlaw the use of radar detectors. It is also a pain in the butt for the MDS and satellite television people, who would like to have the government protect their transmissions so they won't have to encode them. My hope is that they be as successful with the FCC as amateurs have been.

The recent Florida attempt to outlaw radar detectors on the basis of saving gas is just another illustration of the blindness and stupidity of many legislatures. Study after study has shown that the 55 mph speed limit has so little effect on saving gas that it is ridiculous. It has had no demonstrable effect on saving lives either. It has had a wonderful effect on raising money via speeding tickets, which I think is more to the heart of the matter. A one pound increase in tire pressures would save far more gas than the speed limit. Replacing just 5% of the stoplights of the country with stop signs would save five times as much gas as the government even claims the speed limit has saved. And having all stoplights change to blinking lights late at night would save about a half million gallons of gas a day!

I see no sign that there is any seriousness about saving energy. The highways are still brightly lit all night and many government buildings leave their lights on all night. Sports cars generally use *less* gas at higher speeds than at 55 mph, since they are designed and tuned for the higher speeds.

In the meanwhile, the electronic warfare continues, with the public getting more and more fed up with the lying and harassment. The police are wondering why people think of them as the enemy instead of helpful friends. Now that they have made most of us into criminals, we *are* the enemy . . . unless you are one of those people who are holding up traffic on the parkways by insisting on poking along at 55.

27% IMPORTS

The continuing debacle of Chrysler and the mounting losses to foreign car sales has come as a surprise to Detroit. I am not sympathetic with the problem.

To get into a situation like this, the car manufacturers have had to be deaf and blind to what has been going on. Obviously they don't read the car magazines, whose editorials for the last twenty years have been exhorting Detroit to provide cars which are fun to drive and as economical as those from Europe.

My first foreign car was a Porsche. I started driving with a '40 Ford and then stepped up to a '41 Ford. These lasted me until I got out of school and started to make some money, which brought about my first new car in 1954. I tried a Dodge and brought it back after one weekend . . . it drove like a truck compared to my old Fords. I settled for a new Ford, but I was not a happy person. It was big and clumsy and nowhere near the fun to drive of the pre-war Fords.

In 1957, a good friend of mine, Ken Grayson W2HDM, got involved with an MG sports car and car rallies. I looked over the sports car field and decided on a Porsche Speedster for $3,300. Ken tried my Porsche and then quickly got rid of his MG and got a Speedster. This was like the old Ford, only infinitely better. It could go 120 mph and still be safer to steer and drive than most American cars at half that speed. The handling was incredible and so was the fun.

In no time at all, I got involved in car rallies and began to build up a bunch of trophies, even placing well in some of the Nationals. In 1958, I was made president of the Porsche club and made a club trip to the factory in Stuttgart, where I picked up a car for a friend in New York. After picking it up I drove it all over Europe, even getting some practice at racing with it on the Solitude race track in Stuttgart. Now that's an exciting sport, but far too expensive and time consuming for my life-style.

In the New York area, there was no problem in going on from one to three rallies on a weekend, interspersed with some of the three-day national rallies put on by the Sports Car Club of America. At first I went as a navigator, working on a system which would simplify that chore. I worked it out and then taught it to a few people . . . some to navigate for me while I did the driving and some just friends. I didn't want too many to know about it because it gave a tremendous edge in winning.

For those readers who have never been on a car rally, perhaps I should explain about them. Normally you are given your route instructions about one minute before you start on the drive. Short rallies run perhaps 100 miles and the long ones often 500 or more. You are supposed to always drive within the posted speed limits and to stay exactly on time according to your instructions, which include the average speeds you are to drive. The fun comes in when some of the instructions are a bit vague or you make a wrong turn and then have to play catch up.

In 1959, I got enthused by the newly released Porsche Convertible D and bought one for delivery at the factory. I saved enough on the purchase to pay for the trip to Europe, so it was a good deal. After driving the car for a year, I decided I didn't like it as well as the Speedster, so in 1962 I shipped the old Speedster back to the factory and had it refurbished. They put in the latest and hottest engine and made it just like new . . . which was exciting because they had stopped making that particular model and I liked it. I kept the car until 1972, when I sold it to a dealer. It was rusted out a bit in the floor, but otherwise I'd kept it like new. It had over 200,000 miles on it, probably 50,000 of that on rallies.

Since that time, I've had a number of VWs . . . two vans, both rolled over and demolished by *73* employees . . . a couple of bugs whose engines were burned out by our employees, a Volvo, a Mercedes 300 sedan, some more VWs (hatchback models, both still running from '67 and '68), a Rover 2000TC, probably the finest driving sedan I've ever had, a Datsun 240Z and now a 280Z, a Mazda RX-7, etc. A couple of years ago, I decided to get a van to use as a mobile office and made one of my poorer decisions . . . a Dodge. Not only did the dealer cheat us, but Dodge also refused to do anything about it, saying that their dealers were not their responsibility. The van didn't run much for the first year and a half. Finally, we found a Dodge dealer who could get the engine to run, but it still dies now and then, not encouraging any real confidence in the thing.

Detroit saw sales of VWs and other foreign cars building up over the years and they laughed and ignored it.

Recently, we needed a small sedan for the business. We looked over the market carefully and it came down to a Datsun, Toyota, VW, or Mazda. Nothing made in the US was even in the ball park. Oh, I'm quite familiar with American cars, since these are what I have to rent when I'm on trips to hamfests and conventions. We got a VW Rabbit and it's been perfect.

It isn't a question of the price of the cars as much as it is the handling. Detroit makes nothing like the RX-7 at *any* price. I've visited several American car plants and the difference in worker approach between these and the Porsche plant was vast. The Porsche workers put great pride into every car they worked on. There were no ill-fitting doors, no missed spots of paint, no glue on the upholstery. Everything had to be absolutely first class every inch of the way. Both used production lines for assembly, but in one case the workers had their hearts in their work and in the other they were there for the paycheck and little more . . . getting by.

The result was a Porsche which I used for 15 years and eventually sold for nearly what I paid for it new . . . and which was still running perfectly, even after 200,000 very tough miles. There wasn't a rattle. We'd be using that Rover today if a handyman hadn't totaled it, racing it in our driveway while I was on a trip.

Why is it that virtually all of the improvements in car design have to come from abroad? And why, once they are made, can't Detroit pay attention and at least get there second best . . . instead of last? I think it was the Maserati which inspired the Datsun people to design the 240Z car and mass produce it. This, in turn, brought on the 260Z and 280Z . . . followed by the Porsche 924 look-alike and the Mazda RX-7. You see a lot of all these cars on the roads today, and still Detroit is making nothing comparable . . . at any price.

When was the last time there was anything innovative from Detroit? We are *still* seeing them trying to dump gas guzzlers by offering rebates when there is a serious need for really fuel-efficient cars. I think they could develop a 100-mile-per-gallon car if they wanted to do it. I suspect that such a vehicle would be a combination gas/electric car, with a constant speed engine generating the current. Once you stop asking an engine to provide power over a wide range of speeds, you greatly simplify its design. You also are able to get it to run on almost anything from kerosene to olive oil. The engine becomes simpler and less costly.

By using a battery to store the energy from the engine, you have the power needed to start up the car or to accelerate. On braking, you use the motors which drive each of the wheels as generators and put the current back into the battery instead of wasting all of that work in heat through the brakes. Oh, you don't get very good zero-to-sixty times with such a system, but you do get very dependable transportation and the fuel economy we've been seeking. Not that the car would be too draggy . . . remember that trolley cars have electric motors driving their wheels and they can throw you around pretty well when they start up, with all four motors in parallel across the battery . . . shifting to a series condition for cruising. We have some small, lightweight, solid-state controllers these days which should be ideal for controlling such a system.

Are we ready for a car which can run from gas, diesel fuel, alcohol, or any other common fuel . . . and get over 100 miles per gallon? I think it might sell.

Awards

from page 26

13 North American countries; South American award—work 12 South American countries; European award—work 12 European countries; Oceanic award—work 12 Oceanic countries; Asian award—work 12 Asian countries; African award—work 12 African countries.

5. To apply for any of the six continental awards, prepare a separate list of claimed contacts for each continent, listing all callsigns in prefix order. Include date and time in GMT, and the band and mode of operation.

6. If you are submitting the sixth award application, please emphasize this fact to speed processing of your ultimate WTW award.

7. Do not send QSL cards! Have your list(s) verified by two amateurs, a radio club secretary, or a notary public.

8. Each continental award has an award fee of $3.00 or 8 IRCs. Send your application(s) and fee(s) to: Bill Gosney WB7BFK, *73* Awards Editor, 2665 North Busby Road, Oak Harbor, Whidbey Island WA 98277 USA.

WTW DX LISTING

Over the past year, reference has been made to the new WTW (Work the World) DX listing. In order to avoid the impossible task of having to decide what is and what is not a country for DX purposes, the awards editor and *73 Magazine* staff decided to accept the decisions of the many amateur radio societies of the world. In doing so, special care was taken to ensure that no single organization would dictate the criteria used; instead, the accumulative opinion of all concerned societies would be recognized.

It should be mentioned also that the callsign prefixes shown do not represent all prefixes assigned each country. Listed are only the more common prefixes heard on the band. Naturally, other authorized prefixes will be recognized as well.

NORTH AMERICA

C6	Bahamas
CO	Cuba
FG	Guadeloupe
FG, FS	Saint Martin
FM	Martinique
FO	Clipperton Is.
FP	St. Pierre & Miquelon
HH	Haiti
HI	Dominican Republic
J3, VP2G	Grenada & Dependencies
KC4, KP1	Navassa Is.
KG4	Guantanamo Bay
KL7	Alaska
KP4	Desecheo
KP4	Puerto Rico
KS4, KP3, HK0	Serrana Bank and Roncador Cay
KV, KP2	Virgin Islands
OX, XP	Greenland
PJ6, 8	Saba Is.
VE	Canada
VE1	Sable Is.
VE1	St. Paul Is.
VO	Newfoundland, Labrador
VP2A	Antigua, Barbuda
VP2D	Dominica
VP2E	Anguilla
VP2K	St. Kitts
VP2L	St. Lucia
VP2M	Montserrat
VP2S	St. Vincent & Dependencies
VP2V	British Virgin Islands
VP5	Turks and Caicos Islands
VP9	Bermuda
W, K, N, A	United States of America
XE	Mexico
XF4	Revillagigedo Islands
ZF	Grand Cayman Islands
6Y	Jamaica
4U	HQ, United Nations
8P	Barbados

SOUTH AMERICA

CE	Chile
CE0A	Easter Is.
CE0X	San Felix
CE0Z	Juan Fernandez
CP	Bolivia
CX	Uruguay
FY	French Guiana
HC	Ecuador
HC8	Galapagos Is.
HK	Colombia
HK0	Bajo Nuevo
HK0	Malpelo Is.
HK0	San Andres & Providencia
HP	Panama
HR	Honduras
HR0	Swan Is.
KZ	Canal Zone
LU	Argentina
OA	Peru
PJ	Bonaire
PJ	Netherlands Antilles
PY	Brazil
PY0	Fernando de Noronha
PY0	St. Peter & St. Paul
PY0	Trinidade & Martim Vaz Is.
PZ	Surinam
TG	Guatemala
TI	Costa Rica
TI9	Cocos Is.
VP1	Belize
VP8	Falkland Is.
VP8, LU	South Georgia Is.
VP8, LU	South Orkney Is.
VP8, LU	South Sandwich Is.
VP8, LU	South Shetland Is.
VP8W	South Grahamland
YN	Nicaragua
YS	Salvador
YV	Venezuela
YV0	Aves Is.
ZP	Paraguay
8R	Guyana
9Y	Trinidad and Tobago

EUROPE

C3	Andorra
CT	Portugal
CT2	Azores
DA-DL	Federal Republic of Germany
DM, DT	German Democratic Republic
EA	Spain
EA6	Balearic Islands
EI	Republic of Ireland
EJ0	Aran Is.
F	France
FC	Corsica
G	England
GD	Isle of Man
GI	Northern Ireland
GJ, GC	Jersey
GM	Scotland
GM	Orkney Islands
GM	Shetland Islands
GU, GC	Guernsey
GW	Wales
HA	Hungary
HB	Switzerland
HB0	Liechtenstein
HV	Vatican
I	Italy
IC	Ischia
IA	Tuscan Archipelago
IS	Sardinia
IT	Sicily
JW	Bear Is.
JW	Svalbard Is.
JX	Jan Mayen
LA	Norway
LX	Luxembourg
LZ	Bulgaria
M1	San Marino
OE	Austria
OH	Finland
OH0	Aland Is.
OJ0	Market Reef
OK	Czechoslovakia
ON	Belgium
OY	Faeroe Islands
OZ	Denmark
PA	Netherlands
SM	Sweden
SP	Poland
SV	Greece
SV	Crete
SV	Dodecanese
SV	Mount Athos
TF	Iceland
UA, UK1, 3, 4, 6	European RSFSR
UA1, UK1	Franz Josef Land
UA2, UK2F	Kaliningradsk
UB, UK, UT, UY5	Ukraine
UC2, UK2	White RSFSR
UO5, UK5O	Moldavia
UP2, UK2B, P	Lithuania
UQ2, UK2G, Q	Latvia
UR2, UK2R, T	Estonia
YO	Romania
YU	Yugoslavia
ZA	Albania
ZB	Gibraltar
3A	Monaco
4U	ITU, Geneva
9A	(See M1)

ASIA

A4X	Oman Is.
A5	Bhutan
A6X	United Arab Emirates
A7X	Qatar
A9X	Bahrain
AP	Pakistan
BV	Taiwan
BY	China
CR9	Macao
EP	Iran
HL, HM	North Korea
HL, HM	South Korea
HS	Thailand
HZ, 7Z	Saudi Arabia
JA-JR	Japan
JR6, KA6	Okinawa (Ryukyu Is.)
JD, KA1	Ogasawara
JT	Mongolia
JY	Jordan
KA	US Military in Japan
OD	Lebanon
S2	Bangladesh
TA	Turkey
UA, UK, UV, UW9-0	Asiatic RSFSR
UD6, UK6C, D, K	Azerbaidzhan
UF6, UK6F, O, Q, V	Georgia
UG6, UK6G	Armenia
UH8, UK8H	Turkoman
UI8, UK8I	Uzbek
UJ8, UK8J, R	Tadzhik
UL7, UK7	Kazakh
UM8, UK8M, N	Kirghiz
VS6	Hong Kong
VS9K	Kamaran Is.
VU	India
VU7	Andaman & Nicobar
VU7	Laccadives
XU	Khmer Republic
XV	Vietnam
XW	Laos People's Dem. Rep.
XZ	Burma
YA	Afghanistan
YI	Iraq
YK	Syria
1S	Spratly
4S	Sri Lanka
4W	Yemen
4X, 4Z	Israel
5B4, ZC	Cyprus
7O	People's Dem. Rep. of Yemen
8Z4	Neutral Zone Saudi Arabia/Iraq
9H	Malta
9H4	Gozo & Comino
9K	Kuwait
9M2	West Malaysia
9M6	North Borneo
9M8	Sarawak
9N	Nepal
9V	Singapore
	Abu Ail, Jabal Attair

OCEANIA

A3	Tonga Republic
CR8	Portuguese Timor
C2	Republic of Nauru
DU	Philippines
FK	New Caledonia
FO	French Polynesia
FW	Wallis & Fortuna Islands
H4, VR4	Solomon Islands
JD, KA1	Minami Torishima
JD, 7J1	Okino Torishima
KB, KH1	Baker, Howland, American Phoenix
KC6	Eastern Carolines
KC6	Western Carolines
KG6, KH2	Guam Island
KG6R	Rota
KG6S	Saipan
KG6T	Tinian
KH6	Hawaiian Islands
KH7	Kure Island
KJ, KH3	Johnston Island
KM, KH4	Midway Island
KP6, KH5K	Kingman Reef
KP6, KH5	Palmyra
KS6, KH8	American Samoa
KW, KH9	Wake Island
KX	Marshall Islands
P2	Papua, New Guinea
T2, VR8	Tuvalu Island
VK	Australia
VK	Lord Howe Island
VK9	Willis Island
VK9	Christmas Island
VK9	Keeling, Cocos Island
VK9	Mellish Reef
VK9	Norfolk Island
VK0	Macquarie Island
VR1	British Phoenix Islands
VR1	Gilbert Island
VR1	Ocean Island
VR3	Christmas Island
VR6	Pitcairn Island
VR7	Line Island, South and Central
VR8	(See T2)
VS5	Brunei
YB, YC, YD	Borneo
YB, YC, YD	Celebes
YB, YC, YD	Java
YB, YC, YD	Sumatra
YB, YC, YD	West Irian
YJ	New Hebrides
ZK1	North Cook Island
ZK1	South Cook Island
ZK2	Niue Island
ZL	New Zealand
ZL	Auckland & Campbell
ZL	Chatham Island
ZL	Kermadec
ZM7	Tokelaus
3D2	Fiji Islands
5W	Western Samoa

AFRICA

A2	Botswana
C5	Gambia
C9	Mozambique
CN	Morocco
CN2	Tangier
CR3	Guinea Bissau
CT3	Madeira Is.
D2, 3	Angola
D4	Republic of Cape Verde
D6	Comoros
EA8	Canary Islands
EA9	Ceuta and Melilla
EA9	Ifni
EA9	Rio de Oro
EL	Liberia
ET2	Eritrea
ET3	Ethiopia
FB8W	Crozet
FB8X	Kerguelen Is.
FB8Z	Amsterdam & St. Paul
FH	Mayotte
FR	Glorioso Island
FR	Juan de Nova, Europa
FR	Reunion
FR	Tromelin
H5	Bophuthatswana
IG	Lampedusa Island
IH	Pantelleria Island
J2, FL8	Djibouti
S7	Seychelles
S8	Transkei
S9	Sao Tome and Principe
ST	Sudan
ST0	South Sudan
SU	Egypt
TJ	Cameroon
TL	Central African Empire
TN	Congo
TR	Gabon
TT	Chad
TU	Ivory Coast
TY	Benin
TZ	Mali
VK0	Heard Island
VQ9	Aldabra Island
VQ9	Chagos (Diego Garcia)
VQ9	Desroches
VQ9	Farquhar
XT	Upper Volta
ZD7	St. Helena
ZD8	Ascension Island
ZD9	Gough Island and Tristan da Cunha
ZE	Rhodesia
ZS1, 2, 4, 6	South Africa
ZS2	Prince Edward Island
ZS2	Marion Island
ZS3	Southwest Africa (Namibia)
3B6, 7	Agalega & St. Brandon
3B8	Mauritius
3B9	Rodriguez Island
3C	Equatorial Guinea
3D6	Swaziland
3V	Tunisia
3X	Republic of Guinea
3Y	Bouvet Island
5A	Libya
5H	Tanzania
5N	Nigeria
5R	Malagasy Republic
5T	Mauritania
5U	Niger
5V	Togo
5X	Uganda
5Z	Kenya
6O	Somali
6W	Senegal
7P	Lesotho
7Q	Malawi
7X	Algeria
8Q, VS9	Maldive Islands
9G	Ghana
9J	Zambia
9L	Sierra Leone
9Q	Republic of Zaire
9U	Burundi
9X	Rwanda

LETTERS

from page 22

socialism, but I can't believe that the average Canadian is any better or worse than the average American. After all, the US has already gone a long way down the road to socialism, without calling it by that name. Since most of Mexico wants to be American, we can just open the gates wide and let the majority come up here; then we can send them back south to annex the territory they left. No sweat.

By the way, are you really sure that the NATO countries are "on our side"? Lots of luck.!

The subject of the draft vs. an all-employee military establishment is almost too much for me to tackle this late in the afternoon. That gets all involved in the aims and will of the American people. I see two possible options you may have not considered: (1) make the DOD entirely a contractor operation, and (2) just disband the whole thing and devote those resources to other things. How about a guaranteed annual wage for everyone, working or not? Free medical and dental care for all? Free lunch???

Several years ago, I concluded that the American Empire had reached its peak sometime in the late forties or early fifties and had entered the Decline and Fall period. Given this premise, what the hell difference does it make whether we have a draft-based citizens' military or an all-employee military or none at all? (I discarded the contract operation due to the huge requirement for purchasing and contracting officers to negotiate and administer the thing.)

What does all of this have to do with amateur radio? Not much. It's an interesting hobby in many ways, but I get the impression that you believe that most of the ills of man can be overcome by spreading it throughout the world. Sorry, can't go along with you on that. Hams are just a microcosm of the population at large, unfortunately. So keep up the good magazines and don't forget the words of the famous philosopher who said "You'll never go broke by underestimating the intelligence of the American people!"

Irv Hamlin WD4CKA
Sevierville TN

Well, thanks somewhat, Irv, for a good deal of heat but little light on a wide variety of matters. Having been a member of the League for some 42 years, I am not about to tar myself as a member with my own brush. But then the problems with the ARRL have very little to do with any of the membership, nor are they such that the members can do much about them. That still is no reason to sweep these problems under the table and try to pretend that they don't exist, which seems to be your mood. Amateur radio is no world panacea, nor has anyone ever suggested such a thing . . . but it can be of tremendous value to the lesser developed countries to help them improve their communications capabilities at low cost.—Wayne.

PROGRESS

I would like to comment on Wayne's remarks in the April, 1980, issue of *73* on how the "new ASCII rules are asinine." First, the good news. I agree that we should be allowed to transmit data with any digital code (perhaps filing a sample copy with the FCC) as long as we properly identify in Morse or by some other standard means. I haven't seen the complete FCC ASCII ruling yet, so I don't know if they are going to allow that much latitude or not. (That's it for the good news.)

The preliminary information on the new FCC ASCII rules that I read in *QST* for March looked very reasonable, in my opinion, regarding the ASCII data rates to be authorized in the various bands. I disagree very strongly that W2NSD should be allowed to run 9600 baud or greater in any band he desires. The last thing I want to hear on 20 meters is splatter from W2NSD on top of all the other QRM and QRN. I think the future holds more and more stations desiring to use the limited frequencies that are available, and under those circumstances, allowing unlimited bandwidths is not very responsible. If he'd like to run over 9600 baud below 420 MHz where it will be legal, wouldn't he also like to run about 25 kW also? That ought to help get him through all that QRM better.

In his remarks he asserted that by allowing the very wide bandwidths one would be "trading off bandwidth for time." I think that is humorous. Do the SSB stations occupying the 75m phone band accomplish their communications and then go off the air in one-tenth the time an 80m CW station spends transmitting? I think not. With the possible exception of well organized and run traffic nets, I seriously doubt that increasing the "data rate" of the medium will reduce the time spent on occupying spectrum space. We would just find it practical to send 16 k-byte high resolution TV images instead of SSTV. We'll still spend all Saturday morning on the air to one station or another. Now, one might want to argue that these new exchanges are desirable—but that is different from trying to convince someone that the transmitters will spend any less time on the air.

I think "progress" is in a direction where we learn to make better use of our limited spectrum space. By "better," I mean higher speed and more highly reliable communications between stations, per unit of occupied bandwidth and per unit of radiated power. I don't think W2NSD at 19.6 kilobits per second and 10 kW all over the 20-meter band is progress.

Jerome T. Dijak W9JD/DA1FE
APO New York

Jerome, readers advise me that, using compression and expansion techniques, it is practical to send ASCII at 9600 baud over the telephone lines. The bandwidth involved is less than we have available for the normal ham voice channels. So much for your straw man splatter from W2NSD on 20m . . . baloney. And just because we "have always" communicated in real time doesn't mean that there is no other way. The fact is that ham RTTY operators often allow considerable lapses between transmissions so they can read the copy and think about it before replying. If we are able to communicate via a narrowband channel at a rate of 5,000 or more words per minute, I suspect that most of the time the channels will be quiet and that several contacts will be practical on single channels. But if we are able to send information at even higher rates, the amount of time we need for transmission will again go down and the efficiency of use of a given bandwidth . . . no matter what it is . . . will be satisfied. We will find ourselves limited, as we are now, by the rate at which we are able to assimilate information and respond to it, not so much by the slowness of the medium of transfer.—Wayne.

MEETING CHALLENGES

Your May, 1980, editorial provided a very interesting look into some of the possibilities of the future. I would like to add some comments and observations of my own.

One of the most interesting challenges facing us will be efficient use of spectrum to cope with the growth we hope and need to experience in the coming years. You mentioned time-saving new modes of communication. Let us hope we can acquire the cooperation we need from the FCC to freely develop new modes of communication. In addition to spectrum efficiency, we desperately need the shot in the arm that our image will receive from our contributions to the state of the art. These new modes could give a real boost to traffic handling and other public service duties involving information exchange.

However, we must not lose sight of the importance of that idle personal contact which is best achieved on good old SSB and CW. With the combination of CW's inherent narrow bandwidth and some of the excellent audio techniques for separating the signals, few modes would be more spectrum efficient. But more importantly, CW and SSB remain excellent ways for the ham on a tight budget to be an active member of the ham community.

About those new bands—

don't be too quick to write them off. Too many of us pick a favorite band and just sit there. After a few years, our bandswitch is hopelessly frozen on, say, 14 MHz, and the vfo won't turn above or below a range of a couple hundred kilohertz. We have an excellent opportunity to improve our communications capability by making better use of HF propagation characteristics. Too many newcomers aren't aware of the basic principles involved in efficient HF frequency selection. Maybe, as some of the new bands open up in the coming years, we can have some articles on this aspect of operating and oil up the old bandswitch. The increased circulation will give the vitality of youth our hobby needs in order to grow.

And about those small countries—the sooner we get ham radio started there, the better. We mustn't wait until just before the next WARC. In these times of international turmoil, the international goodwill of amateur radio is more important than ever, but it can't work where there are no hams. In addition, these countries will benefit from the technology—technology which could help them peaceably take their place in our modern world. Isn't that what we all want?

We face a serious challenge—grow or die. We need growth in numbers, technology, activities, and public service. Each of us can make contributions, even if it's only in the perfection of our on-the-air habits and attitudes. One of the greatest strengths of amateur radio is that meeting such challenges is not drudgery, but part of the fun.

Jim Glover WB5UDE
Ruston LA

RATIONAL

I have been wanting to write to you concerning the March issue of *73 Magazine*. I really enjoyed the two articles by I. M. Gottlieb!

In the article "Ham Shack Numerology," those "irrational" constants become so "rational" when W6HDM dealt with them! Wonder what he could do with logarithms!

Also, I hope he'll treat us to another phase-velocity escapade with Madame Z!

H. M. S. Richards, Jr. WD6BDZ
Glendale CA

PROSPECTS

Wayne has come a long way since I met him here in Phoenix nearly 20 years ago.

Having lost all my hearing in one ear and 80% in the other, communicating with the public has been a problem. Mine is "nerve deafness," in which all words are garbled.

Enter Joe Grahn W7AH, who some 25 years ago introduced me to amateur radio. Since the CW signals are mechanical, with the volume turned up I was able to communicate with over 6000 hams.

Then in 1960 Joe told me about RTTY, and I now have no need for a hearing aid or interpreter to "see-talk" with other hams.

I have been spending a lot of time in gathering information on hearing and speech impairment. With this thought in mind, I want to start a non-profit association for hearing- and speech-impaired amateur radio operators. If amateurs or individuals who have this problem would send me their names and addresses, along with suggestions as to what is needed to get started, I would appreciate it. 27 million people in the United States have a hearing or speech impairment and 7.2% of the population is totally deaf. Those are a lot of prospects for ham radio to look into.

Ed Truxal W6TUO/7
3925 E. Nisbet Rd.
Phoenix AZ 85032

THE WATCH

The other Saturday morning I was working a little nice DX, and I was blown into my wastebasket by the dreaded woodpecker. I swore revenge. Recent articles about over-the-horizon HF radars suggested that a string of dits, timed to be roughly the same rep rate as the bugger's pulses, might give him QRM. I had a vision of hum-bars dancing in Ivan's scope as I adjusted the keyer and let fly.

Wonder of wonders! He was gone! As I tuned around, I found I was wrong. He had only moved up 100 kHz. Was I the reason he moved or was I kidding myself? I listened to see if he would move again. I noticed that he operates on two frequencies with a string of pulses on one, and then another string on a different frequency separated by about 25 kHz. (Perhaps to resolve inconsistencies in the first scan by using a slightly different wavelength, and comparing the two scans in a micro and keeping the common elements.)

I satisfied myself that he was on this new frequency to stay—and then I zapped him. He moved. I found him again. I just listened for a while. He stayed put. I zapped him. He moved!

I chased the bastard up and down 15 meters for about 20 minutes. As long as I left him alone, he stayed put. As soon as I sent him a 5- to 10-second string of dits, he moved. *Every time*!

I was using the 400-Hz filter in the AM mode on my Drake twins to locate the center of his signal, and had the transmitter slaved to the receiver vfo. That means I was within his passband and on top of him immediately every time he moved. Then he went QRT.

I would like to call for OPERATION 'PECKERWATCH to begin immediately. Anyone can play. Mission: Find 'em . . . chase 'em . . . zap 'em.

There's not much we can do about SW broadcasters invading our bands, but it looks like he have the power to make Moscow change the channel on the HF radar. Score one for the little guy!

Name and address withheld by request

THE MS EXPEDITION

In celebration of its 50th anniversary, campers and staff members of Camp Hy-Lake, a summer camp for boys and girls in Quebeck, Tennessee, are planning a canoe trip down the Mississippi River. Hailed to be the first such event attempted by a summer camp, the 1039-mile trip will see two 26-foot, 25-year-old war canoes en route from St. Louis, Missouri, to New Orleans, Louisiana.

This ambitious event, named simply "The Mississippi Expedition," will begin on August 11 and end on August 29. The canoeists will spend a total of 19 days on the Mississippi, averaging 54.7 miles per day at a speed of about 8 miles per hour, paddling some seven hours per day.

As part of our extensive safety plan designed for the expedition, we have chosen to utilize not only the normal Marine Radio Service, but also the Amateur Radio Service. By having these services available to us on the river, we will maintain a consistent source of communications with families and other parties at destination sites.

In order for this plan to be successful, we need assistance in procuring necessary equipment, supplies, and the attention of radio operators along the proposed course. We need to alert ham radio operators who may be willing to serve as contacts at pre-scheduled times and locations during the expedition.

Please contact me if you can help us in our venture. Your assistance will be most appreciated and we will make every effort to gain exposure for your participation. Thank you for your cooperation.

Ward C. Akers
Director, Camp Hy-Lake
Quebeck TN 38579

SPOTS

When I looked at the sun on May 22nd with my six-inch telescope, I found it to be loaded with spots . . . this increase after dropping off for the past three months. What happened to the 84- and double-84-year *low* sunspot cycles that 11 of the 15 cycle-21 forecasters were depending on . . . including myself?

I mentioned this recently to a cycle expert and he said, "Don't sell the 84-year cycle short; the 1980s are young yet."

For my part, I would not care to attempt to predict another sunspot cycle because the sun is too whimsical. I'll stick to predicting conditions and frequencies, my specialties.

John Nelson
Whiting NJ

HATS OFF

I have just finished reading the June, 1980, issue of *73* and would like to comment on a couple items. With regard to the "Leaky Lines" column concerning S-meters, hats off to Dave for a great piece. Maybe if more people read it we all can get some good reports (honest reports). Next, I have been reading your magazine steadily for 3 years and off and on for 15 years. I have really enjoyed the articles and projects and look forward to many, many more. Thank you. My current subscription expires in '81 and I do plan on renewing.

Thomas C. Huber WD0BFO
Omaha NE

OLD QSLS

First, let me say thanks to *73* for printing my letter in the December, 1979, issue, listing some old QSLs I have. I purchased them from a stamp and coin dealer who'd bought them at an estate sale. If any of the following are still active, they can send their names and QTHs and I'll send the card. None of the following was in my December letter.

NU1WV – '28
W2JC – '30
U2RD – '27
W3AWU – '30
3BPP – '25
3DD – '26
3TR – '24
4AV – '27, "J.M.(4QN)OPR."
4JR – '25
5ADE – '25
5AJJ – '24
5FT – '24
5IQ – '22, "1 kW Spark"
W6AFV – '31
7AKU – '28
W8AUV – '29
U8BGW – '26
8BWK – '24
W8GGX – '32
9AIG – '21, "1 kW Rotary Gap"
9BDR – '22, "¾ kW 'Rotorery' Gap"
W9BNR – '31, "The Sleepless Wonder"
9EJY – '25
9PN – '22
W9VVM – '37, "Davenport's First es Only Blind Opr."
G8IP – '49
KH6AJP – '51

Also, I'd like to locate a source for copies of reproductions of "ARRL List of Stations – First Edition, 1914" that were made around 1964. I believe copies of volumes 2 and 3 were also printed at the same time.

Gary Payne WD6BJK
1347 E. Dakota
Fresno CA 93704

DIRTY LAUNDRY?

I would just like to congratulate you, the editors of *73*, on a superb May issue. This particular copy now sits in an honored place next to my dirty laundry.

If only I had had this issue last summer when I set up my shack, I could have saved the 80 bucks I spent on a trap vertical. The next time I need an antenna, I'll check *73*.

May's issue also gave me a chance to agree with Wayne Green—there's a first time for everything. We should refurbish the CIA with, perhaps, Mr. Green, a closet mercenary, at its helm.

Dave Mihelcic KA9EKW
Belleville IL

BACK ISSUES

I recently offered 115 lbs. of back issues of *73* to the first club or individual to get a message to me.

The first contact was from Minot ND. To date, I have received 76 letters and over 55 phone calls regarding the back issues. Six included SASEs for information regarding the issues. One guy named Jack failed to include his call or return address and the post office failed to cancel his letter, so I don't know where it came from!

I was surprised at the response and am sorry that I couldn't send issues to all who contacted me.

David D. Blackmer WA6UNK
Nipomo CA

New Products

from page 31

The unit's power supply and speaker are included in this cabinet, and a massive heat sink spans the full length of the rig's rear panel. A number of RCA-type phone jacks below the heat sink provide input/output connections for external items such as speaker, phone patch, linear amplifier control, transverters, etc., while an SO-239 connector is used for external antenna connection. The KWM-380's front panel is uncluttered and functional; there's "finger room" between the knobs, and the main tuning knob measures a surprising 2¼ inches in diameter. There are 5 positions of selectivity in the KWM-380, with optional filters providing selectivity to 140 Hz as desired.

A microprocessor-controlled frequency synthesizer is used for all frequency determinations. A set of front-panel pushbuttons thus selects tuning rates of 9 MHz, 170 kHz, 18.7 kHz, or 1500 Hz per dial revolution. It's quite an experience to use the 1500-Hz rate and turn the main tuning dial a full half turn without losing a specific station! The two completely independent frequency registers in the KWM-380 provide extensive flexibility for the serious amateur. One register (vfo), for example, can be used for operation on the SSB portion of 15 meters, while the other register (vfo) can be used for operation on the CW portion of 20 meters. Switching the front-panel vfo selector then permits full operating capabilities on each of these bands as desired. If it's desired to bring both vfo's onto the same band and frequency, one merely presses the "sync" button while the desired frequency is displayed.

The KWM-380's bandpass tuning is quite effective in both rejecting adjacent channel interference and in tailoring audio response according to received signals. A pleasant side benefit of this tuning is the control's wide range and noncritical adjustment. The combination of bandpass tuning and five i-f bandwidths is extremely effective in combatting high interference levels experienced on the high frequency amateur bands.

Inside, the KWM-380 reflects quality construction and advanced design which should maintain its status for many years. PC boards are connected by lengths of ribbon cable to permit in-circuit checks without the use of extender boards. Board placement in the KWM-380 resembles microprocessor layouts, with ample room to permit airflow for internal cooling. A massive transformer and 5-inch speaker are mounted in the transceiver's right inside area.

The KWM-380 is one of the most pleasing and enjoyable rigs I've used on the air. Its instant-on capabilities, coupled with its two independent vfo's, permit maximum use of available "on-the-air" time. In a thirty-minute period, for example, I worked DX on 20 CW, checked into the Saturday SSTV nets on 20 and 10 SSB, chased some DX on 15 meters, and checked the WWV propagation bulletins at 18 minutes after the hour.

The i-f filters definitely reflect Collins influence, as their skirts are quite sharp. Half-clear SSB signals can be copied smoothly with the 8-kHz bandpass—and the quality is extremely good. When the usual 2.2-kHz bandpass is used, it's possible to hear voice characteristics and microphone response which other rigs miss. The 1700-Hz filter provides a fine "DXer's edge" for pulling weak signals from the mud, and it substantially decreases atmospheric noises. The KWM-380, with its optional filters, is a particularly outstanding 160-meter DX rig. Obviously, the narrow CW filters and continuous bandpass tuning provide superb CW DXing capabilities.

Frequency stability of the KWM-380 is another direct reflection of Collins influence. During several checks, the unit didn't drift over ten cycles during the first three hours after a cold turn-on. What else could one ask!

Power output of the KWM-380 measures between 105 and 110 Watts on all bands, and it drives my L4B amplifier to exactly the same output as my Yaesu FT-901DM.

The main tuning assembly is somewhat "light" compared to other Collins systems. The lack of flywheel action and a counterbalanced tuning knob reflect, in my opinion, the Rockwell influence on this classic product. All aspects considered, the KWM-380 is an outstanding unit which reflects its heritage and stands worthy of its name. It should be with us for a number of years, thus protecting its owners' initial investment in the true Collins manner. While the rig may lack some of the presently popular "bells and whistles" included in import gear, its contemporary nature can be appreciated by amateurs desiring long-range consistency and quality. I compare the KWM-380 in this respect to a contemporary suit versus "mod" or "fad" clothes, the former maintaining its style and appeal long after the latter has "bloomed" and disappeared.

Thanks to Ack Electronics in Birmingham for lending me the rig for review. For further information, contact *Collins Telecommunications Products Division, Rockwell International, Cedar Rapids IA 52406.* Reader Service number 483.

Dave Ingram K4TWJ
Birmingham AL

KENWOOD R-1000 GENERAL COVERAGE RECEIVER

With the profusion of new general coverage receivers now coming on the market, the selection may become bewildering to the prospective buyer. But one cost-effective receiver stands out above the crowd: the Kenwood R-1000.

Compactly packaged (12¾" × 4½" × 8½"), the handsome styling of the R-1000 is in keeping with the entire Kenwood communications line. The ruggedly-built receiver has a carrying handle which doubles as a tilt bracket. Plastic feet are also provided for flat tabletop operation. The well-built receiver weighs 12 pounds, and may be operated from 100-240 V ac mains, 50/60 Hz. An optional 12 V dc power cable is available as the DCK-1 for about $6.

The R-1000 tunes continuously from 200 kHz (and below) to 30 MHz, with AM or switch-selectable sideband modes.

Frequency readout is announced by a brilliant fluorescent display accurate to 1 kHz (3 decimal places). Additionally, a backlighted fiducial dial provides secondary frequency indication. Bandswitching is done in one-megahertz increments; because tuning is self-tracking, no additional preselector peaking is required!

Both thermal and mechanical stability are excellent. In our particular sample, there was no noticeable drift at turn-on; this feature alone makes the receiver an outstanding value for single-sideband reception. The printed specifications allow the receiver 300 Hz per half hour drift after initial warm-up. Tuning "feel" is velvety-smooth; a finger hole on the main tuning knob permits rapid frequency selection. Selectivity is 2.7 kHz @ −6 dB, and 5 kHz @ −60 dB on SSB/CW; an internal jumper allows AM selectivity of either 6/12 kHz or 2.7/6 kHz. An inexpensive conversion kit is available from Kenwood dealers to update the improved selectivity on older models. Agc release time is much improved over early models.

The digital display doubles as a 12-hour clock; AM/PM is also shown. An integral timer permits remote activation of a tape recorder, or simply provides for the receiver to be used as an expensive alarm clock!

To reduce strong-signal overload, a step attenuator switch is provided with increments of 0, 20, 40, and 60 dB. This feature is very useful for reduction of intermod products which may occur under certain strong-signal conditions.

A concentric tone control mounted on the volume control shaft provides moderate "treble" reduction. A built-in speaker affords excellent audio quality without introducing vibration instability to the receiver's performance.

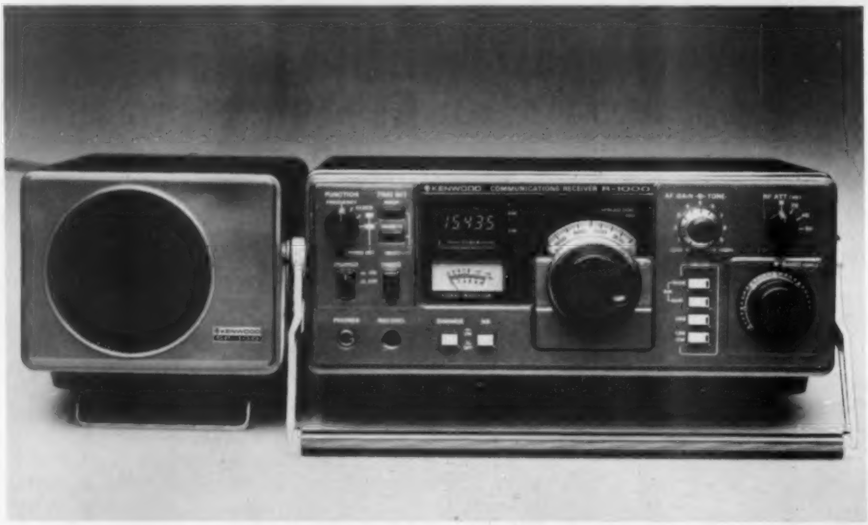
The noise blanker in the R-1000 deserves special comment. It is not merely another audio noise limiter. It is a complex pulse-noise eliminator capable of totally removing sharp electrical interference without degrading signal intelligibility in the slightest.

The rear apron allows a choice of antennas from coaxial-cable-fed (SO-239 connector provided) to random wire (spring-loaded terminals also provided). No ridiculous attached ferrite loop or built-in whip!

Internally, the PC board is a study in clean layout. Components are clearly identified, and the board itself is held securely in place by nine screws on nylon standoffs.

The circuit board is interconnected to the rest of the receiver by mating connectors and wiring harnesses.

The liberal use of Murata filters provides the i-f selectivity skirts which make reception on the cluttered shortwave bands much easier.



Kenwood's R-1000 general coverage receiver.

Spring-loaded mating gears prevent tuning mechanism backlash, and an all-brass gear mechanism lends more than a touch of professionalism to the mechanical design.

The use of subchassis modules divides functional portions of the circuit for easy troubleshooting and repair should it ever become necessary.

Additional plugs and jacks allow the use of an external speaker, headphones, tape recorder, and tranceive operation.

The R-1000 is accompanied by an excellent owner's manual. It is well-written, highly instructional, liberally illustrated, and quality-printed.

In sum, the new Kenwood R-1000 general coverage communications receiver offers low cost with no compromise. To quote a concerned competitor of Kenwood, "The R-1000 is the one to beat!" We couldn't agree more.

For further information, contact *Trio-Kenwood Communications, Inc., 1111 West Walnut, Compton CA 90220.*

Bob Grove WA4PYQ
Brasstown NC

SOFTWARE FROM THE PERIPHERAL PEOPLE

Radio amateurs will be interested in three new programs that have just been announced by The Peripheral People.

The first, called CODEFILE, permits transmission of data stored on diskettes by means of Morse code. The user specifies the sending speed (up to 50 wpm) and the file name to be transmitted. The program then converts the file contents to Morse code and transmits it as MCW out the cassette CSAVE jack.

While manual copy of long programs and text can be somewhat tedious, CODEFILE can be used in conjunction with CODECOPY, which translates the incoming code to screen display and hard copy printout. No hardware is required, although the user may wish to construct a simple VOX circuit to translate the audio tones into keying pulses in HF operation. CODEFILE is available on diskette only and works with either 32K or 48K systems.

Written for the TRS-80, HAMCALL is a disk-based sequential access program that will easily maintain club, net, or individual records. It can be used with one or more disk drives and 32-48K of memory.

In addition to the usual name and address information, HAMCALL allows each record to be individually coded by interest, bands of operation, equipment, or any other codable information. Records can be selectively displayed or printed out using these codes. The printout can be a tabular listing or in the form of labels (1-4 across). HAMCALL also has the ability to sort by call letters (prefix or suffix), last name, or zip code.

MORSECOPY, also written for the TRS-80, translates incoming code (applied to the cassette CLOAD plug) and displays it on the screen. No hardware is required for VHF-modulated CW transmissions. Audio which exceeds the threshold level of the TRS-80 cassette input is passed for translation and screen display or hard-copy printout. A simple audio filter (using either 88-mH toroids or an operational amplifier) is required to separate interfering signals on the HF bands. Either circuit can be easily constructed by radio amateurs.

MORSECOPY will translate and display transmissions up to 35 wpm if the cassette load modification has not been incorporated by Radio Shack. The installation of this modification will slow the translation speed slightly. The program can cope with minor changes in speeds and has "catch up" provision if the sending speed is significantly increased or decreased.

For additional information, contact *The Peripheral People, PO Box 524, Mercer Island WA 98040; 206-232-4505.* Reader Service number 480.

KLM's 40-10V MULTIBAND VERTICAL

KLM's 40-10V multiband vertical uses a series of lossless linear loading and efficient hi-Q air capacitor sections on 20, 15, and 10 meters similar to those on the highly successful KT-34A and KT-34XA tribanders. Old-style power-robbing coils and capacitors have been completely eliminated.

The 40-10V provides broadband coverage. *All* of 40 meters is accessible (with no tuning adjustment) at 1.51:1 vswr and better. Optimized tuning is also possible using the adjustable element tip. And, just two settings on each band provide complete coverage of 20, 15, and 10 meters at 1.51:1 vswr and better.

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Tim Daniel N8RK
73 Staff

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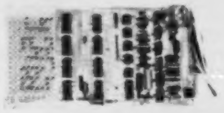

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OSCAR Orbits

Courtesy of AMSAT

Any satellite placed into a near-Earth orbit suffers from the cumulative effects of atmospheric drag. The much publicized descent of the Skylab space station was a graphic demonstration of these effects.

The OSCAR satellites are subject to atmospheric drag, of course, and the present period of intense solar activity has accentuated the problem. During this period, our sun has been expelling huge numbers of charged particles, some of which find their way into the Earth's upper atmosphere, increasing the density (and thus the drag) there. It is through this region that the OSCARs must pass. OSCAR 8, in a lower orbit than OSCAR 7, is the more seriously affected of the two.

If the drag factor is not considered when OSCAR calculations are performed, long-range orbital projections will be in error. For example, by the end of 1979, OSCAR 8 was more than 20 minutes ahead of some published schedules. The nature of orbital mechanics is such that extra drag on a satellite causes it to move into a lower orbit, resulting in a shorter orbital period. Thus, the satellite arrives above a given Earthbound location earlier than predicted.

Using data supplied to us by Dr. Thomas A. Clark W3IWI of AMSAT, the equatorial crossing tables shown here were generated with the aid of a TRS-80™ microcomputer. The tables take into account the effects of atmospheric drag and should be in error by a few seconds at most.

The listed data tells you the time and place that OSCAR 7 and OSCAR 8 cross the equator in an ascending orbit for the first time each day. To calculate successive OSCAR 7 orbits, make a list of the first orbit number and the next twelve orbits for that day. List the time of the first orbit. Each successive orbit is 115 minutes later (two hours less five minutes). The chart gives the longitude of the day's first ascending (northbound) equatorial crossing. Add 29° for each succeeding orbit. When OSCAR is ascending on the other side of the world from you, it will descend over you. To find the equatorial descending longitude, subtract 166° from the ascending longitude. To find the time OSCAR 7 passes the North Pole, add 29 minutes to the time it passes the equator. You should be able to hear OSCAR 7 when it is within 45 degrees of you. The easiest way to determine if OSCAR is above the horizon (and thus within range) at your location is to take a globe and draw a circle with a radius of 2450 miles (4000 kilometers) from your QTH. If OSCAR passes above that circle, you should be able to hear it. If it passes right overhead, you should hear it for about 24 minutes total. OSCAR 7 will pass an imaginary line drawn from San Francisco to Norfolk about 12 minutes after passing the equator. Add about a minute for each 200 miles that you live north of this line. If OSCAR passes 15° east or west of you, add another minute; at 30°, three minutes; at 45°, ten minutes. Mode A: 145.85-.95 MHz uplink, 29.4-29.5 MHz downlink, beacon at 29.502 MHz. Mode B: 432.125-.175 MHz uplink, 145.975-.925 MHz downlink, beacon at 145.972 MHz.

At press time, OSCAR 7 was scheduled to be in Mode A on odd numbered days of the year and in Mode B on even numbered days. Monday is QRP day on OSCAR 7, while Wednesdays are set aside for experiments and are not available for use.

OSCAR 8 calculations are similar to those for OSCAR 7, with some important exceptions. Instead of making 13 orbits each day, OSCAR 8 makes 14 orbits during each 24-hour period. The orbital period of OSCAR 8 is therefore somewhat shorter: 103 minutes.

To calculate successive OSCAR 8 orbits, make a list of the first orbit number (from the OSCAR 8 chart) and the next thirteen orbits for that day. List the time of the first orbit. Each successive orbit is then 103 minutes later. The chart gives the longitude of the day's first ascending equatorial crossing. Add 26° for each succeeding orbit. To find the time OSCAR 8 passes the North Pole, add 26 minutes to the time it crosses the equator. OSCAR 8 will cross the imaginary San Francisco-to-Norfolk line about 11 minutes after crossing the equator. Mode A: 145.85-.95 MHz uplink, 29.4-29.50 MHz downlink, beacon at 29.40 MHz. Mode J: 145.90-146.00 MHz uplink, 435.20-435.10 MHz downlink, beacon on 435.090 MHz.

OSCAR 8 is in Mode A on Mondays and Thursdays, Mode J on Saturdays and Sundays, and both modes simultaneously on Tuesdays and Fridays. As with OSCAR 7, Wednesdays are reserved for experiments.

OSCAR 7 ORBITAL INFORMATION FOR AUGUST

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26125	1	0100:14	89.1
26137	2	0007:32	73.9
26150	3	0101:40	87.5
26162	4	0001:06	72.4
26175	5	0055:22	86.0
26188	6	0149:37	99.5
26200	7	0048:56	84.4
26213	8	0143:11	98.0
26225	9	0042:30	82.8
26238	10	0136:45	96.4
26250	11	0036:03	81.3
26263	12	0130:19	94.9
26275	13	0029:37	79.7
26288	14	0123:53	93.3
26300	15	0023:11	78.1
26313	16	0117:27	91.7
26325	17	0016:45	76.6
26338	18	0111:00	90.2
26350	19	0010:19	75.0
26363	20	0104:34	88.6
26375	21	0003:53	73.4
26388	22	0058:08	87.0
26401	23	0152:23	100.6
26413	24	0051:42	85.5
26426	25	0145:57	99.1
26438	26	0045:16	83.9
26451	27	0139:31	97.5
26463	28	0038:50	82.3
26476	29	0133:05	95.9
26488	30	0032:24	80.8
26501	31	0126:39	94.4

OSCAR 8 ORBITAL INFORMATION FOR AUGUST

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
12267	1	0042:29	63.8
12281	2	0047:17	65.0
12295	3	0052:04	66.3
12309	4	0056:51	67.5
12323	5	0101:39	68.7
12337	6	0106:26	69.9
12351	7	0111:13	71.1
12365	8	0116:00	72.4
12379	9	0120:48	73.6
12393	10	0125:35	74.8
12407	11	0130:22	76.0
12421	12	0135:09	77.2
12435	13	0139:56	78.5
12448	14	0001:31	53.9
12462	15	0006:17	55.1
12476	16	0011:04	56.3
12490	17	0015:51	57.5
12504	18	0020:38	58.8
12518	19	0025:24	60.0
12532	20	0030:11	61.2
12546	21	0034:57	62.4
12560	22	0039:44	63.6
12574	23	0044:30	64.8
12588	24	0049:17	66.1
12602	25	0054:03	67.3
12616	26	0058:49	68.5
12630	27	0103:35	69.7
12644	28	0108:22	70.9
12658	29	0113:08	72.1
12672	30	0117:54	73.4
12686	31	0122:40	74.6

OSCAR 7 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
26513	1	0025:57	79.2
26526	2	0120:12	92.8
26538	3	0019:31	77.7
26551	4	0113:46	91.2
26563	5	0013:05	76.1
26576	6	0107:20	89.7
26588	7	0006:39	74.5
26601	8	0100:54	88.1
26613	9	0000:12	73.0
26626	10	0054:28	86.5
26639	11	0148:43	100.1
26651	12	0048:01	85.0
26664	13	0142:16	98.6
26676	14	0041:35	83.4
26689	15	0135:50	97.0
26701	16	0035:09	81.9
26714	17	0129:24	95.4
26726	18	0028:43	80.3
26739	19	0122:58	93.9
26751	20	0022:16	78.7
26764	21	0116:31	92.3
26776	22	0015:50	77.2
26789	23	0110:05	90.8
26801	24	0009:24	75.6
26814	25	0103:39	89.2
26826	26	0002:57	74.0
26839	27	0057:13	87.6
26852	28	0151:28	101.2
26864	29	0050:46	86.1
26877	30	0145:01	99.6

OSCAR 8 ORBITAL INFORMATION FOR SEPTEMBER

ORBIT #	DATE	TIME (GMT)	EQ. CROSSING (DEGREES WEST)
12700	1	0127:26	75.8
12714	2	0132:12	77.0
12728	3	0136:58	78.2
12742	4	0141:43	79.4
12755	5	0003:17	54.9
12769	6	0008:03	56.1
12783	7	0012:49	57.3
12797	8	0017:34	58.5
12811	9	0022:20	59.7
12825	10	0027:06	60.9
12839	11	0031:51	62.1
12853	12	0036:36	63.4
12867	13	0041:22	64.6
12881	14	0046:07	65.8
12895	15	0050:52	67.0
12909	16	0055:38	68.2
12923	17	0100:23	69.4
12937	18	0105:08	70.6
12951	19	0109:53	71.8
12965	20	0114:38	73.1
12979	21	0119:23	74.3
12993	22	0124:08	75.5
13007	23	0128:53	76.7
13021	24	0133:38	77.9
13035	25	0138:22	79.1
13049	26	0143:07	80.3
13062	27	0004:40	55.7
13076	28	0009:25	56.9
13090	29	0014:09	58.2
13104	30	0018:54	59.4

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47 CFR Part 97

[PR Docket No. 79-285; RM-3207; RM-3313; FCC 80-288]

Amateur Radio Service; Deleting Restriction Which Limits The Allowable Bandwidth of Frequency Modulated (FM) Voice Emissions in the 50-54 MHz Band

AGENCY: Federal Communications Commission.

ACTION: Final Rule.

SUMMARY: In the Amateur Radio Service, the Commission is deleting the restriction which limits the allowable bandwidth of frequency modulated (FM) voice emissions in the 50-54 MHz band. The restriction is technologically obsolete. The effect of this action is to allow the use of conventional land-mobile FM voice emission between 50.1 MHz and 52.5 MHz.

EFFECTIVE DATE: July 14, 1980.

ADDRESSES: Federal Communications Commission, Washington, DC 20554.

FOR FURTHER INFORMATION CONTACT: Maurice DePont or Jay Jackson, Private Radio Bureau (202) 254-6884.

SUPPLEMENTARY INFORMATION: In the matter of amendment of § 97.65(c) of the Commission's rules and regulations governing the Amateur Radio Service, PR Docket 79-285, RM-3207, RM-3313. See also 44 FR 64442, November 7, 1980.

Report and Order

Adopted: May 29, 1980.

Released: June 10, 1980.

1. Our Notice of Proposed Rule Making in this proceeding was released on October 31, 1979, and published in the **Federal Register** on November 7, 1979 (44 FR 64442). In the Notice, we proposed to amend § 97.65(c) so that the frequency modulated (FM) voice emission bandwidth limitation contained therein would no longer apply to the 6 meter amateur band (50-54 MHz). We further proposed to delete the phrase "* * * and the purity and stability of emissions shall comply with the requirements of § 97.73." since it is redundant.

2. Section 97.65(c) currently limits the maximum allowable bandwidth of an FM voice emission, transmitted between 50.1 and 52.5 MHz, to that of an amplitude modulated (AM) voice emission having the same audio characteristics. At the present time, most amateur rario operators who use FM use the FM emission which is standard in the commercial land-mobile radio services. Because this emission has a wider bandwidth than an AM voice emission having the same audio characteristics, it may not currently, under the rules, be transmitted between 50.1 and 52.5 MHz. Removing the restriction, as proposed, would allow the use of this conventional land-mobile FM voice emission between 50.1 and 52.5 MHz.

3. We received forty-nine comments and reply comments in this proceeding. Fourteen staunchly supported the proposal and urged that it be adopted as presented. Eleven favored the proposal, but had reservations about it which found expression in counterproposals of various sorts. These counterproposals generally offered alternative frequency segments where conventional land-mobile FM voice emissions should not be permitted. The remaining twenty-four flatly disagreed with the proposal and

requested that the rule remain unchanged.

4. The issue in this proceeding is whether or not a technologically obsolete restriction should be retained in a portion of the 6 meter band. However, the comments focused on the question of whether or not conventional land-mobile FM voice emissions can co-exist with single sideband voice emissions. Opponents of the proposal were concerned that FM users would take over the entire 6 meter band and preclude its use by single sideband users. Proponents of the proposal, on the other hand, believed that amateur radio operators could and would successfully resolve any problems by voluntarily developing sharing arrangements and band-plans which would accommodate most, if not all, of the various operating interests.

5. We agree with the proponents of the proposal. We expect that the experience which amateur radio operators have gained through developing successful sharing arrangements in the 144 MHz, 220 MHz, and 420 MHz bands will be brought into play, and that frequencies in the 6 meter band will continue to be used in a manner that is satisfactory to all concerned. We believe that the inherent flexibility in this approach outweighs any difficulty which amateur radio operators might have in reaching sharing agreements. Therefore, we are removing the FM voice emission bandwidth restriction from the 6 meter band.

6. We are also deleting the phrase in § 97.65(c) which refers to § 97.73. That latter section, which deals with the purity and stability of emissions, applies to all amateur radio transmitters, regardless of the type of emission used. Thus, the reference to it in § 97.65(c) is unnecessary.

7. Accordingly, it is ordered, that, effective July 14, 1980, Part 97 of the Commission's rules is amended as shown in the Appendix attached below. Authority for this action is found in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended. It is further ordered, that this proceeding is terminated and the docket is closed.

8. For further information on this rule change, contact Maurice DePont or Jay Jackson, (202) 254–6884.

(Secs. 4, 303, 48 Stat., as amended, 1066, 1082; (47 U.S.C. 154, 303))

Federal Communications Commission.

William J. Tricarico,

Secretary.

Appendix

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

In § 97.65, paragraph (c) is amended to read:

§ 97.65 Emission limitations.

* * * * *

(c) On frequencies below 29.0 MHz, the bandwidth of an F3 emission (frequency or phase modulation) shall not exceed that of an A3 emission having the same audio characteristics.

* * * * *

[FR Doc. 80-17933 Filed 6-12-80; 8:45 am]

BILLING CODE 6712-01-M

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47 CFR Part 97

[Docket No. 21135; FCC 80-285]

Simplification of the Licensing and Call Sign Assignment Systems for Stations in the Amateur Radio Service

AGENCY: Federal Communications Commission.

ACTION: Third Report and Order.

SUMMARY: In the Amateur Radio Service, the Commission is authorizing modification and renewal only of existing club and military recreation station licenses. Likewise, in the Radio Amateur Civil Emergency Service (RACES), only modification and renewal of station licenses will be permitted. New station licenses for these types of stations will not be granted.

EFFECTIVE DATE: July 14, 1980.

ADDRESSES: Federal Communications Commission, Washington, D.C. 20554.

FOR FURTHER INFORMATION CONTACT: Maurice J. DePont, Private Radio Bureau, Rules Division, (202) 254–6884.

SUPPLEMENTARY INFORMATION: In the matter of the simplification of the licensing and call sign assignment systems for stations in the Amateur Radio Service, Docket No. 21135, see also 43 FR 15325, March 13, 1979.

Third Report and Order

Adopted: May 29, 1980.

Released: June 10, 1980.

1. Our Notice of Proposed Rule Making in this proceeding was released on March 11, 1977, (42 FR 15438). In it, we proposed to simplify the amateur licensing structure by discontinuing the issuance of all station licenses other than primary and space station, i.e., we would no longer issue secondary, special event, club, military recreation, RACES, repeater, auxiliary or control station licenses. Our goal was to simplify our application processing system in order to provide an efficient licensing service to the public, within our manpower and resource allocations.

2. The comments received in response to the Notice showed how deeply concerned amateur licensees were about our proposal to eliminate club, military recreation and RACES station licenses. Accordingly, the Commission issued a Further Notice of Proposed Rule Making on February 23, 1978, (43 FR 7332), proposing to license these stations in a way that would conserve staff resources. The Further Notice proposed that distinctive call signs be assigned these stations. The prefixes WK, WM, and WC would be assigned to club, military recreation, and RACES stations, respectively. In addition, expiration dates for these types of stations were to be staggered in order to reduce the Commission's workload. Eligibility for club station licenses was to be revised to require new and existing licensees to demonstrate a compelling need for such licenses. No trustee was to be required for a club station. Comments to the Further Notice were due on or before June 2, 1978, with reply comments due on or before June 30, 1978.

3. Approximately 150 comments and reply comments were received in response to the Further Notice. Most of the comments dealt with the proposal to assign a WK prefix to club stations. The opponents felt that presently licensed club stations should be allowed to retain and renew their licenses, keeping their present call signs. They did not want a distinctive club prefix that would identify club stations as a class. It was felt that the present club call sign fostered a sense of identity among club members and created good will in the community for the club. The present club licensees who commented also believed that a club should not have to show a compelling need in order to obtain a license. The proposal to eliminate club trustees likewise met with a negative response, since present licensees felt it was desirable to have someone in charge who would be responsible for the proper operation of the station.

4. The comments showed how much amateur operators want to have a familiar club call sign when they participate in field day activities and when they operate their stations to assist in times of emergencies. The Enid Amateur Radio Club, Inc., Enid, Oklahoma, brought out the economic hardship for clubs, if they were assigned new call signs: "There is much sentimentality attached to this call sign. All our records, our stationery, our publicity signs, QSL cards, equipment, our clubroom—these all are emblazoned with our call sign. Every magazine in the club library has been stamped with (the club call sign) for identification of ownership."

5. With respect to military recreation and RACES stations, the comments filed by the Department of Defense (DOD) supported the continued issuance of a separate RACES license with a distincitive call sign to each civil defense organization. DOD also wanted separate licenses for military recreation stations, with a call sign that would preserve the historical identity of the station, arguing that such stations are unique and contribute to the morale and welfare of military personnel.

6. We have reviewed carefully all the comments filed in response to the Further Notice in this proceeding. We appreciate the investment, both emotional and financial, that amateur operators have in their call signs. Therefore, we believe that the public interest will be served by accommodating present licensees of club, military recreation, and RACES stations by granting modification and renewal of existing licenses. In this connection, a change in the trustee of a club, person in charge of the military recreation station, or responsible civil defense official will be treated as a modification to the existing station license. In addition, a change in the station location or a change in the name of an existing station will be construed as a license modification. No new call signs would be assigned.

7. We would anticipate that the desire for a new license would arise most often in connection with club stations. We would expect that the members of a club would select a licensed amateur radio operator as trustee for the station and then use the trustee's primary station call sign as the club's call sign. Moreover, there would be no objection, after the station had identified with the primary station call sign, to the control operator's adding-on the club's name as further identification. We believe that there is merit in limiting the proliferation of call signs and that it comports with our efforts to deregulate the Amateur Radio Service. Further, the tradition for self-regulation by Amateur radio licensees assures us that full responsibility for a station's operation will be borne by the primary station licensee.

8. Accordingly, it is ordered, that, effective July 14, 1980, Part 97 of the Commission's rules is amended as shown in the Appendix attached below. Authority for this action is found in Sections 4(i) and 303(r) of the Communications Act of 1934, as amended. The disposition of the question concerning the licensing of club, military recreation, and RACES stations is the sole remaining issue in this docket. Inasmuch as our action herein resolves the matter, this proceeding is hereby terminated and the docket is closed.

9. For further information on these rule changes contact Maurice J. DePont, (202) 254–6884.

(Secs. 4, 303, 48 stat., as amended, 1066, 1082; (47 U.S.C. 154, 303))

Federal Communications Commission.

William J. Tricarico,

Secretary.

Appendix

Part 97 of Chapter I of Title 47 of the Code of Federal Regulations is amended, as follows:

1. The present text of § 97.37 is designated as paragraph (a) and a new paragraph (b) is added to read as follows:

§ 97.37 General eligibility for station license.

(a) An amateur radio station license will be issued only to a licened amateur radio operator, except that a military recreation station license may also be issued to an individual not licensed as an amateur radio operator (other than a representative of a foreign government), who is in charge of a proposed military recreation station not operated by the U.S. Government but which is to be located in approved public quarters.

(b) Only modification and/or renewal station licenses will be issued for club and military recreation stations. No new licenses will be issued for these types of stations.

2. The present text of § 97.171 is designated as paragraph (a) and a new paragraph (b) is added to read as follows:

§ 97.171 Eligibility for RACES station license.

(a) A RACES station will only be licensed to a local, regional, or state civil defense organization.

(b) Only modification and/or renewal station licenses will be issued for RACES stations. No new licenses will be issued for RACES stations.

[FR Doc. 80-17931 Filed 6-12-80; 8:45 am]

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Ham Help

I need a schematic and operating instructions for the AN/USM-81 oscilloscope made by Hickok. I also need a parts list and schematic for a Honeywell Model 782 strobe. I will be happy to pay for any copying and shipping charges. Thanks.

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Castro Valley CA 94546

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1263 Lakehurst Rd.
Livermore CA 94550

I am looking for a schematic or information on the Friden Flexowriter Programatic Typewriter. I have a Model FPC-5P which has a 5-level Baudot paper tape punch/read assembly. I would like to interface this for computer use or RTTY.

Robert G. Gilman
Box 103
Hellertown PA 18055

Corrections

Those who built my "Cheapy Scanner for the Memorizer" (April, 1980) may wish to add another feature to it.

In the article, I stated that one should be able to add an auto-reverse feature by simply decoding the 4 and 8 of the 144-148. By adding two chips and one resistor, you can build this circuit in one evening. Follow the same procedure as for the scanner. Follow Fig. 1, work slowly, and double-check your wiring. Happy scanning.

Steve Laufer WA2ORU
Fair Lawn NJ

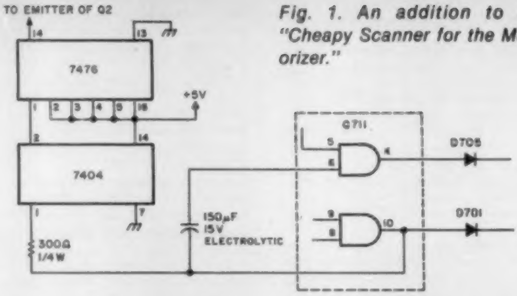
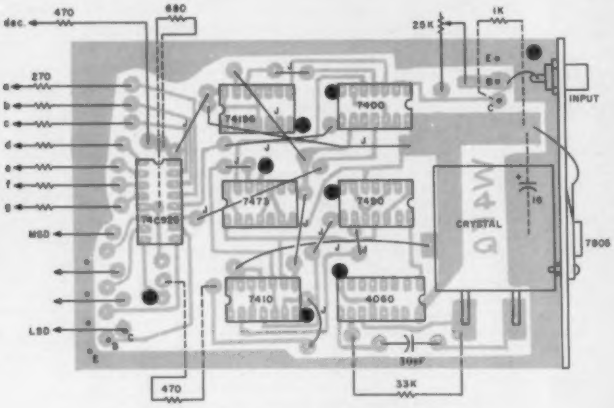


Fig. 1. An addition to the "Cheapy Scanner for the Memorizer."

Some corrections for my article "Electronic Dice—A Family Pleaser" (June, 1980): U2 and U4 should be labeled 4522; U3 should be labeled 4511; and U7 should be U5 and is a 4511. All pin connections shown on all ICs are correct.

Howard F. Batie W7BBX
Herndon VA



Revised Fig. 3, "Down with Interpolation."

There are several corrections to my article "Down with Interpolation," which appeared in the June issue.

First, in Fig. 1, the readout schematic, the ground pin on the 7473 should be labeled 11, not 7. The pins at the bottoms of the LEDs should be labeled 4 or 12. The 7400 series TTL ICs can be replaced by 74LS types with a slight reduction in current consumption.

Also, in Fig. 3, the parts placement, one jumper was shown incorrectly and one omitted. A corrected version is shown here.

I have been advised by O. C. Stafford, 427 South Benbow Road, Greensboro NC 27401, that he will supply the PC board for $7.50 postpaid. Finally, the patterns shown in Fig. 4 are not to scale and cannot be used as templates.

Brooks Carter W4FQ
Irmo SC

My article "The Stolen Rig Retriever" appeared in your June issue. Your readers may wish to know that although Intel Electronics has discontinued the manufacture of the no. 3622 PROM, Fairchild Electronics has a direct replacement, no. 93446.

A kit of parts, including the PROM programming, is available from Alpha Electronics Laboratories, 2302 Oakland Gravel Rd., Columbia MO 65201.

Harlan C. Curtis WB6KBM
Diamond Bar CA

Ham Help

I need an operator's manual for a Tequipco Model 3 in-circuit transistor and diode checker. The manufacturer was Test Equipment Corp., Houston TX. I will pay for copy or original.

E. W. Lambert
2227 Center Terrace
Grand Island NY 14072

Does anyone out there recognize any of the following computer circuit cards? These are all hamfest specials bought to build a cheap computer. Any photocopies of condensed manuals or schematics would be appreciated. I will pay for the favor. I've included all identification I could find. Thanks.

1. Datamedia 8080A CPU card. 2DAAA005, 9.36 MHz xtal, dated April 21, 1978, 2 2101. 2 empty 2101 slots, about 50 TTL, 2 28-pin sockets, all chips TI, 100-pin edge connector (not S-100). I got 2 for $5.00 each. Maybe it goes to a Datamedia smart terminal.

2. Small, unknown 6503 card. 6503, 6530, 6532 chips, 3.579 xtal, 36-pin connector on one side, 38-pin connector on other side, paper tag says "P/A model µP7-1, Rev. C C11-80139" on card. I paid $25.00. Maybe a video processor?

3. Big Univac memory card. ID numbers 7318-2-73 (1973?), 38-75, BE-3, Assy. 4161700-05. 72 Intel 4915636 MOS, B7720A chips (18-pin, 256 × 4 RAMs?), 2 100-pin connectors on one side, "3534009-01 Rev. G 127" stamped on other edge connector. I paid $5.00.

4. Small RAM cards. I was told they go to "Accukeyer." "Memory Bd. 1769-25" stamp. 24 Intel C1101A 256 × 1 RAMs, 2K × 3, 44-pin connector. I got 4 for $2.50 each.

Charles Gerbino
1831 Stanley Place
Falls Church VA 22043

I would like to obtain the schematic and service manual (will reproduce and return, if desired) for a Victor Company (Japan) 5" B&W TV, Model 4T-2OU and companion power supply, Model AC 21.

Joe Hustak WA5ZNQ
6821 NW 27th Street
Bethany OK 73008

I have a Hallicrafters SX-62A and need an operator's manual, schematic, alignment instructions, etc. (original or copies). I will pay for postage and copying. Please send a postcard.

Del Ogren WD9DNU
565B Lynn Ct.
Glendale Hts IL 60137

I am looking for a Mars vfo RX-2 or RA-2 which was part of the Galaxy transceiver line. Any help would be appreciated.

Louis Sila
1085 W. 27th St.
San Bernardino CA 92405

I am looking for a schematic for the Spectronics digital display Model DD-1. I will pay for copying and postage.

Francis J. Wittlinger K4QCO
4271 Pine St.
West Palm Beach FL 33406

Ham Help

I recently bid on a Collins KW-1 unit. As a schoolteacher, I would like to sponsor an amateur radio club—if I can obtain information on how the Collins KW-1 can be converted to SSB. I need to know how to bias the circuits and final amplifier to class AB1 operation from class C. Any information on using a Central Electronics phasing exciter to drive the KW-1 would be appreciated.

Stan Moraski N8BOH
7681 Fairmont Rd.
Russell Twp.
Novelty OH 44072

I desperately need one set of front-panel handles for a R-390 receiver.

Terry Simonds WB4FXD/1
PO Box 1558
Edgartown MA 02539

I would like to borrow or buy information and manuals on the following recently acquired surplus equipment: AM 3203/TRC 24; AM 914/TRC; Polarad Receiver R-B1; Polarad MSG-2, RS-T, RX-T; Polarad STU 4W/TSA-W, C-Band.

John Spigel WB2PAZ
1166 Middletown-Lincroft Rd.
Middletown NJ 07748

I need a schematic and instruction manual for a Hallicrafters SX-100 general coverage receiver.

Robert Bunn WA0LKE
Rt. 3, Box 565
West Plains MO 65775

I need a manual for a Midland 13-520 HT. I will copy and return promptly, or buy copy.

Jung Y. Lem KB6BO
5222 Coringa Dr.
Los Angeles CA 90042

I need the complete article and schematic on the "5-Band 50-Watt CW Transmitter" using a 12BY7 oscillator and 6DQ6B final which was in the 1968 or 1969 ARRL *Handbook*. I will be happy to pay for copying and mailing costs for a copy of the article or for the complete handbook at a reasonable price.

Bill Graham N8BMK
Box A 233A Rt. 5
Paris KY 40361

I need a service and operating manual and schematics for a Hammarlund HQ-150 receiver. I will copy and return *pronto*, or pay for same.

Wm. Ryan
163 W. Peterson
Brighton MI 48116

I would like to get in touch with hams who will be attending the Phoenix Institute of Technology in September in hopes of starting a club.

Rick Todd KA8AKL
14470 Basslake Rd.
Newbury OH 44065

Greenpeace, the anti-whaling organization, is in need of a San Francisco Bay area site for its ham station. The site must be able to accommodate a tower, a large log periodic antenna and high power. Those with a site or suggestions should contact me at the address below.

Dick Dillman N6VS
435 Utah Street, No. 4
San Francisco CA 94110
Phone: (415)-864-6320

I am most anxious to acquire acknowledgement cards from the ham radio station CE0AE on Easter Island (possession of Chile) which operated between 25 Nov 1968 and 31 Jan 1971. I wonder if any of your readers can help me out.

R. P. Alexander
4507 Van Ness St. NW
Washington DC 20016

I need a schematic and/or circuit information for a suitable noise-blanker circuit to use in a Hammarlund HQ-180A receiver.

Robert F. Cann W4GBB
1606 Lochwood Drive
Richmond VA 23233

I need any information on hints, kinks, and modifications for the Yaesu FT-101E. I am willing to pay.

Brian Stoll N8AFX
3025 Brockman
Ann Arbor MI 48104

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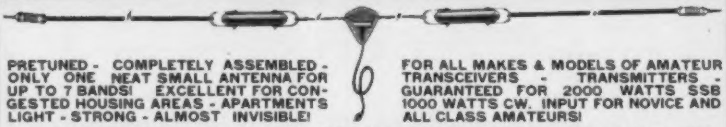

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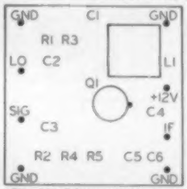

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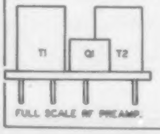

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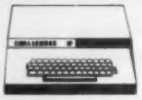

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LM309K	1.50
LM311H/N	.90
LM317T/K	3.75
LM318	1.35
LM320K-5	1.50
LM323K-5	5.95
LM320K-12	1.50
LM320K-15	1.50
LM320T-5	1.35
LM320T-8	1.35
LM320T-12	1.35
LM320T-15	1.35
LM324N	1.40
LM339N	1.00
LM340K-5	1.35
LM340K-8	1.35
LM340K-12	1.35
LM340K-15	1.35
LM340K-24	1.35
LM340T-5	1.25
LM340T-8	1.25
LM340T-12	1.25
LM340T-15	1.25
LM340T-18	1.25
LM340T-24	1.25
LM350	7.50
LM377	3.50
LM379	6.00
LM380N	1.00
LM381	1.50
LM382	1.00
LM703H	.65
LM709H	.28
LM723H/N	.50
LM733N	.85
LM741CH	.35
LM741N	.30
LM747H/N	.75
LM748N	.35
LM1303N	1.75
LM1304	1.10
LM1305	1.27
LM1307	2.00
LM1310	2.75
LM1458	.47
LM1800	1.75
LM1812	7.50
LM1889	3.00
LM2111	1.75
LM2902	2.25
LM3900N	.60
LM3905	1.75
LM3909N	.95
MC1458V	.50
NE550N	1.00
NE555V	.39
NE556A	.85
NE565A	1.00
NE566V	1.50
NE567V	1.00
NE570B	4.75
78L05	.60
78L08	.60
78M05	.85
75108	1.75
75491CN	.50
75492CN	.55
75494CN	.89

A to D CONVERTER

8038B	4.50
8700CJ	13.95
8701CN	22.00
8750CJ	13.95
LD130	9.95
9400CJV/F	7.40
ICL7103	9.50
ICL7107	14.25

CMOS

CD4000	.35
CD4001	.35
CD4002	.35
CD4006	1.10
CD4007	.35
CD4008	.39
CD4009	.45
CD4010	.45
CD4011	.35
CD4012	.30
CD4013	.47
CD4014	1.25
CD4015	1.00
CD4016	.56
CD4017	1.05
CD4018	.94
CD4019	.45
CD4020	1.02
CD4021	1.35
CD4022	1.10
CD4023	.30
CD4024	.75
CD4025	.28
CD4026	2.95
CD4027	.69
CD4028	.85
CD4029	1.35
CD4030	.45
CD4035	1.35
CD4040	1.35
CD4042	.85
CD4043	.85
CD4044	.85
CD4046	1.67
CD4049	.45
CD4050	.45
CD4051	1.13
CD4060	1.42
CD4066	.71
CD4068	.40
CD4069	.40
CD4070	.55
CD4071	.45
CD4072	.45
CD4073	.45
CD4075	.45
CD4076	1.65
CD4078	.40
CD4081	.35
CD4082	.35
CD4116	.47
CD4490	5.50
CD4507	1.00
CD4508	4.25
CD4510	1.02
CD4511	.94
CD4515	2.52
CD4516	1.10
CD4518	1.02
CD4520	1.02
CD4527	1.51
CD4528	.79
CD4553	3.50
CD4566	2.25
CD4583	2.35
CD4585	1.10
CD40192	3.00
74C00	.35
74C04	.40
74C10	.35
74C14	1.95
74C20	.35
74C30	.35
74C48	2.25
74C74	.85
74C76	1.75
74C90	1.75
74C93	1.75
74C154	3.00
74C160	2.00
74C175	1.35
74C192	2.25
74C221	2.50
74C905	6.00
74C906	.75
74C914	1.95
74C922	6.00
74C923	6.00
74C925	7.50
74C926	8.95
74C927	8.95

INTERFACE

8095	.65
8096	.65
8097	.65
8098	.65
8T09	1.25
8T10	4.50
8T13	3.00
8T20	5.50
8T23	3.10
8T24	3.50
8T25	3.20
8T26	1.69
8T28	2.75
8T97	1.00
8T98	1.00

MOS/MEMORY RAM

2101-1	2.95
2102-1	.95
2102AL-4	1.25
2102AN-2L	1.00
21L02-1	1.10
2104A-4	4.95
2107B-4	3.75
2111-1	3.75
2112-2	3.95
2114L 300ns	7.40
2114L 450ns	6.40
4116 200ns	9.50
8/4116 200ns	69.00
25120	6.30
MM5262	.40
MM5280	3.00
MM5320	9.95
MM5330	5.94
PD411D-3	4.00
PD411D-4	5.00
P5101L	8.95
4200A	9.95
82S25	2.90
91L02A	1.50
HD0165-5	6.95
MM57100	4.50
GIAY38500-1	9.95
MCM6571A	9.95
9368	3.50
4100	10.00
416	16.00

CLOCKS

MM5311	5.90
MM5312	3.90
MM5314	3.90
MM5369	2.10
MM5841	14.45
MM5865	7.95
CT7001	5.80
CT7010	8.95
CT7015	8.95
MM5375AA/N	3.90
MM5375AG/N	4.90
7205	16.50
7207	7.50
7208	15.95
7209	4.95
DS0026CH	3.75
DS0056CN	3.75
MM53104	2.50

MICROPROCESSOR

6502	10.95
6504	9.95
6522	9.95
6800	6.95
6802	11.95
6820	4.95
6850	5.95
8080A	5.95
8085	12.95
8086	75.00
Z80	9.95
Z80A	11.95
8212	2.90
8214	3.95
8216	2.90
8224	3.45
8228	4.95
8251	6.95
8253	15.00
8255	5.75
8257	10.95
8259	14.95
1802CP plas.	13.95
1802DP plas.	17.95
1861P	11.50
CDP1802CD	19.95
CDP1802D	25.00
CDP1861	12.95

UART/FIFO

AY5-1013	5.50
AY5-1014	7.50
3341	6.95

PROM

1702A	4.95
2513 upper case	6.95
2708	7.75
2716 T1	24.50
2716 Intel	34.95
8/2716 Intel	240.00
2732	65.00
2758	22.50
8741A	65.00
8748	75.00
8748-8	70.00
8755A	65.00
N82S23	2.95
N82S123	5.50
N82S126	3.75
N82S129	5.50
N82S131	5.50
N82S136	8.75
N82S137	8.75
DM8577	2.90
8223	2.90

CONNECTORS

30 pin edge	2.50
44 pin edge	2.75
100 pin edge	4.50
100 pin edge WW	5.25

IC SOCKETS
Solder Tin Low Profile

PIN	1 UP	PIN	1 UP
8	.15	22	.30
14	.14	24	.30
16	.16	28	.42
18	.27	36	.58
20	.29	40	.57

2 level 14 pin ww .20

WIRE WRAP LEVEL 3

PIN		PIN	
14	.32	24	.88
16	.33	28	1.00
18	.57	40	1.23

CRYSTALS

1 MHz	4.50
2 MHz	4.50
4 MHz	4.25
5 MHz	4.25
10 MHz	4.25
18 MHz	3.90
20 MHz	3.90
32 MHz	3.90
32768 Hz	4.00
1.8432 MHz	4.50
3.5795 MHz	1.20
2.0100 MHz	1.95
2.097152 MHz	4.50
2.4576 MHz	4.50
3.2768 MHz	4.50
5.0688 MHz	4.50
5.185 MHz	4.50
5.7143 MHz	4.50
6.5536 MHz	4.50
14.31818 MHz	4.25
18.432 MHz	4.50
22.1184 MHz	4.50

KEYBOARD ENCODERS

AY5-2376	$12.50
AY5-3600	17.95
AY5-9100	10.50
AY5-9200	16.50
74C922	5.50
74C923	5.50
HD0165-5	6.95
AY5-9400	10.50

D Connectors RS232

DB25P	2.95
DB25S	3.95
Cover	1.50
DE9S	1.95
DA15P	2.10
DA15S	3.10

[illegible] 3½ Digit LED multimeter	69.95
Stopwatch Kit	26.95
Auto Clock Kit	17.95
Digital Clock Kit	14.95

8K/16K Eprom Kit (less PROMS)	$89.00
Motherboard	$39.00
Extender Board	$9.99

RESISTORS ¼ watt 5%
10 per type .03
25 per type .025
100 per type .015
1000 per type .012
350 piece pack
5 per type 6.75
½ watt 5% per type .05

Televideo
Terminal 912 $845.00

KEYBOARDS

56 key ASCII keyboard kit	$67.50
Fully assembled	77.50
53 key ASCII keyboard kit	60.00
Fully assembled	70.00
Enclosure Plastic	14.95
Metal Enclosure	29.95

LEDS

Red TO18	.15
Green, Yellow TO18	.20
Jumbo Red	.20
Green, Orange, Yellow Jumbo	.25
Clipite LED Mounting Clips	8/$1.25

(specify red, amber, green, yellow, clear)

CONTINENTAL SPECIALTIES in stock
Complete line of breadboard test equip.
MAX-100 8 digit Freq. Ctr. $128.95
OK WIRE WRAP TOOLS in stock
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Complete line of AP Products in stock.

SPECIAL PRODUCTS

MM5865 Stopwatch Timer with 10 pg. spec.	9.00
PC board	7.50
Switches Mom. Pushbutton	.27
3 pos. slide	.25
Encoder HD0165-5	6.95
Paratronics 100A Logic Analyzer Kit	$224.00
Model 10 Trigger Expander Kit	$229.00
Model 150 Bus Grabber Kit	$369.00
Sinclair 3½ Digit Multimeter	$59.95
Clock Calendar Kit	$23.95
2.5 MHz Frequency Counter Kit	$37.50
30 MHz Frequency Counter Kit	$47.75

TRANSFORMERS

6V 300 ma	3.25
12 Volt 300 ma transformer	1.25
12.6V CT 600 ma	3.75
12V 250 ma wall plug	2.95
12V CT 250 ma wall plug	3.50
24V CT 400 ma	3.95
10V 1.2 amp wall plug	4.85
12V 6 amp	12.95
12V 500 ma wall plug	4.75
12V 1 amp wall plug	6.50
12V 3 amp	8.50
10/15 VAC 8/16 VA wall plug	9.75

DISPLAY LEDS

MAN1	CA	.270	2.90
MAN3	CC	.125	.39
MAN72/74	CA/CA	.300	1.00
DL704	CC	.300	1.25
DL707/DL707R	CA	.300	1.00
DL727/728	CA/CC	.500	1.90
DL747/750	CA/CC	.600	1.95
DL750	CC	.600	1.95
FND358	CC	.357	.70
FND500/507	CC/CA	.500	1.35
FND503/510	CC/CA	.500	.90
FND800/807	CC/CA	.800	2.20
3 digit Bubble			.80
4 digit Bubble			.80
DG8 Fluorescent			1.75
DG10 Fluorescent			1.75
5 digit 14 pin display			1.00
10 digit display			1.25
7520 Clairex photocells			.39
TIL311 Hex			9.50
MAN3640	CC	.30	1.10
MAN4610	CA	.40	1.20
MAN4640	CC	.40	1.20
MAN4710	CA	.40	.95
MAN4740	CC	.40	1.20
MAN6640	CC	.56	2.95
MAN6710	CA	.60	1.35
MAN6740	CC	.60	1.35

MA1002A	8.95
MA1002E	8.95
MA1012A	8.95
102P3 transformer	2.25
MA1012A Transformer	2.25

Rockwell AIM 65 Computer

6502 based single board with full ASCII keyboard and 20 column thermal printer. 20 char. alphanumeric display, ROM monitor, fully expandable. **$375.00.** 4K version **$450.00.** 4K Assembler **$85.00**, 8K Basic Interpreter **$100.00.**

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AIM65/KIM/VIM/Super Elf 44 pin expansion board; 3 female and 1 male bus. Board plus 3 connectors **$22.95.**

AIM65/KIM/VIM I/O Expansion Kit; 4 parallel and 2 serial ports plus 2 internal timers **$39.00.** PROM programmer for 2716 **$150.00.** 32K RAM Board assem. **$419.00.** 16K RAM assem. **$360.00**

Multi-volt Computer Power Supply

8v 5 amp, ±18v .5 amp, 5v 1.5 amp, −5v .5 amp, 12v .5 amp, −12 option. ±5v, ±12v are regulated. Kit $29.95. Kit with punched frame $37.45, $4.00 shipping. Kit of hardware $14.00. Woodgrain case $10.00, $1.50 shipping.

PROM Eraser

Will erase 25 PROMs in 15 minutes. Ultraviolet, assembled **$37.50**
Safety switch/Timer version **$69.50**

60 Hz Crystal Time Base Kit $4.40

Converts digital clocks from AC line frequency to crystal time base. Outstanding accuracy.

NiCad Battery Fixer/Charger Kit

Opens shorted cells that won't hold a charge and then charges them up, all in one kit w/full parts and instructions. **$7.25**

LRC 7000 + Printer $389.00

40/64 column dot matrix impact, std. paper. Interface all personal computers.

S-100 Computer Boards

8K Static RAM Kit	$129.00
8K Static Godbout Econo IIA Kit	145.00
16K Static Godbout Econo XIV Kit	$285.00
24K Static Godbout Econo VIIA-24 Kit	435.00
32K Static Godbout Econo X-32 Kit	$575.00
16K Dynamic RAM Kit	199.00
32K Dynamic RAM Kit	310.00
64K Dynamic RAM Kit	470.00
Video Interface Kit	**$129.00**

80 IC Update Master Manual $55.00

Complete IC data selector, 2700 pg. master reference guide. Over 51,000 cross references. Free update service through 1980. Domestic postage $3.50. 79IC Master closeout $29.95.

Z80 Microcomputer

16 bit I/O, 2 MHz clock, 2K RAM, ROM Breadboard space. Excellent for control. Base Board $28.50. Full Kit $99.00. Monitor $20.00. Power Supply Kit $35.00.

Video Modulator Kit $8.95

Convert TV set into a high quality monitor w/o affecting usage. Comp. kit w/full instruc.

Modem Kit $60.00

State of the art, orig., answer. No tuning necessary. 103 compatible 300 baud. Inexpensive acoustic coupler plans included.

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Connect your computer to the BSR Home Control System. Computer controlled ultrasonic transmitter for your BSR. Software for 1802 user.

TERMS: $5.00 min. order U.S. Funds. Calif residents add 6% tax.
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✓ Reader Service—see page 195

VINEYARD AMATEUR RADIO WANTS TO BE YOUR HEADQUARTERS FOR OSCAR 9 COMMUNICATIONS WITH KLM EQUIPMENT.

KLM-420-450-18C Circuiar Polarized Antenna (435MHz)	$59.95
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CS-1 Circularity Switcher	$29.95
PA15-11OCL 420-450 MHz Power Amp. (linear)	$329.95
Echo 70 432-435 MHz CW-SSB Transceiver	$379.95
KR-500 rotors	$199.95
Fiberglass circular antenna support mast	$2.00/ft.

These KLM Antennas, Amplifiers, Transceivers and accessories are available for immediate delivery and V.A.R. will pay the U.P.S. on orders placed before 8/30/80.

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All new, all 9 hf bands and only $849!

DELTA – the symbol of change–the name of a great new TEN-TEC transceiver. A transceiver for changing times, with new features, performance, styling, size and value.

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ALL 9 HF BANDS. First new transceiver since WARC. 160-10 Meters including the three new hf bands (10, 18 & 24.5 MHz). Ready to go except for plug-in crystals for 18 and 24.5 MHz segments (available when bands open for use).

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Edge Meter 250 UA. Fits in 5/8" x 1-3/8" hole. MTG holes on each end 1-1/4" behind panel. Black scale 0-5 bottom 1-20 top
$1.25 ea. 5/$5.00

E. F. Johnson Signal Strength Meter 200 UA 2½" x 2½" Sq. mounts in 1¾" hole 1" behind panel. Scale: 1-30 db top 0-5 bottom.
$4.95ea 5/$20.00

PANEL METERS

$4.00 ea 2 for $7.00

25-0-25 dc Volts } 2¼" x 3"

0-25 dc Volts
0-50 ac Volts } 2¼" x 2¼"

-Shunt Required-

Double Row/Wire Wrap .100

25 pins	$3.49 ea	10/$30.00
30 pins	$3.96 ea	10/$32.00
50 pins	$5.43 ea	10/$45.00

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6 pins	$1.10 ea	10/$ 9.00
15 pins	$1.55 ea	10/$12.50
22 pins	$2.08 ea	10/$17.00
43 pins	$3.66 ea	10/$30.00

C & K SWITCHES

PART #	MOVEMENT	
7101	ON/NONE/ON	SPST
7103	ON/OFF/ON	SPST
7108	ON/NONE/(ON)	SPST
7201	ON/NONE/ON	DPDT

$1.00 EA 6 FOR $5.00

6 TV GAMES ON (1) CHIP

Gen Instr AY-3-8500-1
28 Pin Plastic Case
EVERYDAY LOW PRICE $7.50 ea

CB SPECIAL

Brand new printed circuit board assembly. Used in all HyGain 40 Channel CB transceivers. Fits many other manufacturers' units also. Squelch pot/volume control/channel selector switch not included.

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Board Dimensions 6" x 6½"

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New Hy-Gain 40ch CB Less Case, Speaker & Knobs (as is)
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$7.50 ea.

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EFC L455K
$3.50 ea.

8 Position Dip Switches
16 pin (AMP) $1.50 ea.
10/$13.50

15' MODEM CABLES
10#22ga wire w/shield, DB25P conn & DB51226-1 cover on one end
$5.50 ea. 10/$50.00

25' MODEM CABLES
13#22ga wire w/shield, DB25P conn & DB51226-1 cover on one end
$6.50 ea. 10/$60.00

12 Vdc RELAY SPST 35 Amp Contacts

Open Frame
Rugged, great for mobile use
$4.50 ea 5/$20.00

12 Vdc RELAY

SPST Open Frame
5 Amp Contacts
Mfg-Magnecraft
$1.50 ea 4/$5.00

22 pins/Double Row/Dipped Solder
.156 $2.08 ea 10/$17.00

22 pins/Double Row/Wire Wrap
.156 $2.44 ea 10/$19.00

12 V DC Horn
2" diameter x 1¼" deep
.75 each
3/$2.00

100 ASSORTED DISC CAPS (FULL LEADS) 20 EA OF 5 DIFFERENT VALUES $2.00 PER PACK

Autronic Elect Auto Alarm
Easy installation independent circuits solid state 12V neg ground
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4800 μF at 7.5 VDC
1¾" length x 1" diameter
$3.00 each
50 μF at 200 VDC
1¾" length x ¾" diameter
$2.00 each

White Porcelain Egg Insulator

1½" x 1" 50¢ ea. 3 for $1.25

CAPS RADIAL LEADS

2200 uF @ 16V
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SOLDER LUG-TYPE CAPS

50 UF @ 350V 1" D x 3" L
50 UF @ 450V 1" D x 2½" L
50 UF @ 450V 1" D x 3" L
60¢ EA. 5 FOR $2.50

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EFJ CRYSTAL OVENS

6V/12V 75°
$5.00 ea.

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14 pin	.35 ea	10/$3.00
16 pin	.38 ea	10/$3.30

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23/8" x 1" x ⅝"
13KC BW $10.00 ea.

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TRIMMER CAPS

Can fit in your watch
3.5-20 pF & 5-30 pF
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POLY FOAM COAX 50 Ohm

Low Loss = to RG174
$4.95/100' $3.00/50'

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Detects sound above the range of human hearing! Transmits & receives
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Converts motion to ac voltage without mechanical linkage
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12 VOLTS @ ½ AMP

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50 uF @ 15V
2.2 uF @ 25V
3.3 uF @ 25V
1 uF @ 35V
2 uF @ 150V
} 12 ea. for $1.00

25 uF @ 25V
3 uF @ 50V
5 uF @ 50V
10 uF @ 50V
} 15 ea. for $2.00

250 uF @ 25V
100 uF @ 50V
50 uF @ 75V
} 10 ea. for $2.00

ASSORTED ELECTROLYTICS

VALUE/MFD		VOLTS	DIA		LENGTH	PRICE
63,000	@	15V	3"	x	5½"	4.00 ea
10,000	@	20V	1½"	x	53/4"	3.00 ea
2,700	@	25V	1⅛"	x	2¼"	2.00 ea
2,900	@	25V	1⅛"	x	2"	2.00 ea
3,000	@	25V	1½"	x	4½"	2.00 ea
18,000	@	25V	2"	x	4"	3.00 ea
21,000	@	25V	2½"	x	3"	3.00 ea
1,000	@	50V	1⅛"	x	3¼"	2.50 ea
34,800	@	50V	3"	x	5½"	3.00 ea
450	@	75V	1⅛"	x	2¼"	2.00 ea
500	@	100V	1½"	x	3½"	2.00 ea
240	@	300V	1⅛"	x	3⅛"	2.00 ea
50	@	450V	1⅛"	x	2"	2.00 ea

TERMS: *All material guaranteed ● If for any reason you are not satisfied, our products may be returned within 10 days for a full refund (less shipping). Please add $3 for shipping and handling on all orders. Additional 5% charge for shipping any item over 5 lbs. COD's accepted for orders totaling $50.00 or more. All orders shipped UPS unless otherwise specified. Florida residents please add 4% sales tax. Minimum order $15.00.*

EQUIPMENT / COMPONENTS / WIRE & CABLE / ACCESSORIES

THE ZULU IS BACK!

NATIONAL SEMICONDUCTOR **MILITARY TIME FORMAT!**

JUMBO CLOCK MODULE

MA1001C BRAND NEW!

$4.95

FEATURES
- FOUR JUMBO .. INCH LED DISPLAYS
- 12 HR REAL TIME FORMAT
- 24 HR ALARM SIGNAL OUTPUT
- 50 OR 60 Hz OPERATION
- LED BRIGHTNESS CONTROL
- POWER FAILURE INDICATOR
- SLEEP & SNOOZE TIMERS
- DIRECT LED DRIVE (LOW RFI)
- COMES WITH FULL DATA

Add $1.95 for AC XFMR

ASSEMBLED! NOT A KIT!

COMPARE AT UP TO TWICE OUR PRICE!

ZULU

PERFECT FOR USE WITH A TIMEBASE.

MANUFACTURER'S CLOSEOUT!

ALARM CLOCK KITS:

4 Digit .5"

Here it is! The first of several quality kits we have been asked for: Here is what you get — unbelievable as it may sound.

1	National - 5375AA Clock Chip
1	Bowmar Clock Stick Readout (L.E.D.) 4 digit - 1/2"
13	Transitors
2	Push Buttons for time set
2	Toggle Switches for alarm
1	Filter Cap
4	1N4000 series diodes
1	1N4148
2	Disc caps
29	Resistors
1	Transducer (Speaker) for Alarm
1	LED Lamp for alarm indicator

NEW!

$9.99

ORDER KIT CK-100AC

P.C. Board **$2.25**

Plug In Transformer **$1.50**

D.C. MODEL

Includes 60 Hz timebase.

This Kit Includes:

1	National 5375AA Clock Chip
1	Bowmar Clock Stick Readout - (L.E.D.) 4 digit - 1/2"
12	Transistors
2	Push Buttons for time set
2	Disc caps
27	Resistors
1	MOV
1	60 Hz time base

NEW!

P.C. Board **$2.25**

ORDER KIT CK-100DC

$12.75

MICRO MINI TOGGLE SWITCHES

6 for $5 with hardware.

99¢ EACH

★ ★ ★ ★ ★ ★ CABLE TIES ★ ★ ★ ★ ★ ★

MAKE YOUR PROJECTS "NEAT & TIDY." 4" CABLE TIES AT A FANTASTIC PRICE. GET THIS BARGAIN AND "TIE" IT DOWN. **$2.00 for 100 or better yet $15.00 for 1000**

5-14 V.D.C. BETTER BEEPER

Two audio oscillator — a low frequency pulse oscillator — either or both audio frequencies can be shifted (warbled) or pulsed on and off. Constant tone capability. Any combination of pulses and warbles or tones. 1⅞" DX 1¾" ALARMS—TOYS—TESTING—ETC.

P.C. BD. & Complete Kit . . . **$3.55 or 3 for $9**

RCA SENSITIVE GATE TRIAC

TO-5 CASE. HOUSE #40531

ALSO SAME AS T2300D.

2.5 AMPS 400 PIV

5 FOR $1.19

Perfect for Dimmers, Color Organs, etc.

PC LEADS

NON POLARIZED CAPS

200 UF/50 VNPS **4 FOR $1.25**

5 VOLT REED RELAY

An absolutely fantastic item. Compare this price with any advertiser. **While They Last.**

$1.10

Turns on at 10 MA. Drops out at 5 MA.

FACTORY PRIME

5BI - Polar LED 59¢ ea. or 10 for $5

INTERSIL 8038 FUNCTION GENERATOR

Produces sine, square wave, and triangular wave forms. **$3.00 ea.**

14 PIN DIP **5/$12.50**

VARO BRIDGE

In a Mini Dip Package
1A 50 VOLT

2/$1.19

10/$4.90

LAB-BENCH VARIABLE POWER SUPPLY KIT

$12.00 KIT SUPER SALE

5 to 20 VDC at 1 AMP. Short circuit protected by current limit. Uses IC regulator and 10 AMP Power Darlington. Very good regulation and low ripple. Kit includes PC Board, all parts, large heatsink and shielded transformer. 50 MV. TYP. Regulation.

16K DYNAMIC RAM CHIP WORKS IN TRS-80 OR APPLE II

16K X 1 Bits. 16 Pin Package. Same as Mostek 4116-4. 250 NS access. 410 NS cycle time. Our best price yet for this state of the art RAM. 32K and 64K RAM boards using this chip are readily available. These are new fully guaranteed devices by a major mfg.

VERY LIMITED STOCK!

"MAGAZINE SPECIAL"

8/$59.95

60 Hz CRYSTAL TIME BASE

$4.95 (Complete Kit)

Uses MM5369 CMOS divider IC with high accuracy 3.579545 MHZ Crystal. Use with all MOS Clock Chips or Modules. Draws only 1.5 MA. All parts, data and PC Board included. 100 Hz. same as above, except **$5.95**

D.C. HORN

VERY LOUD!
6-12 VDC
Like Used In
Smoke Alarms.
FANTASTIC SAVINGS.
Compare this true value.

.60 ea. 4 For $2.00

SONY 23 WATT AUDIO AMP MODULE

#STK-054. 23 WATTS SUPER CLEAN AUDIO. 20 HZ to 100 KHZ ± 2 DB. HYBRID, SILICON, SELF-CONTAINED MODULE. ONLY 1¾ x 2½ IN. WITH DATA.

COMPARE AT UP TO TWICE OUR PRICE! **$6.50 each**

REPEAT OF A SELL-OUT!

VECO PRECISION THERMISTOR. GLASS TYPE. VECO #41A72. 8.2K OHMS AT ROOM TEMP. **VERY** SENSITIVE. INDIVIDUALLY PACKAGED IN PLASTIC VIALS. $3.00 VALUE

$1.00 each or 3 FOR $2.50

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"COLOSSUS JR." JUMBO CLOCK MODULE

MA1013 BRAND NEW!

$8.50

2 FOR $15

(AC XFMR $1.95)

- Bright 4 digit 0.7" LED Display
- Complete-Add only Transformer and Switches
- 24 Hour Alarm Signal Output
- 12 Hour Real Time Format
- 50 or 60 Hz Operation
- Power Failure Indication
- LED Brightness Control
- Sleep and Snooze Timers
- Alarm "on" and PM Indicators
- Direct Drive - No RFI
- Direct Replacement for MA1012
- Comes with Full Data

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(OF TEXAS)

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TERMS: Add 50¢ postage, we pay balance. Orders under $15 add 75¢ handling. No C.O.D. We accept Visa, MasterCharge and American Express cards. Tex. Res. add 5% Tax. Foreign orders (except Canada) add 20% P&H. 90 Day Money Back Guarantee on all items.

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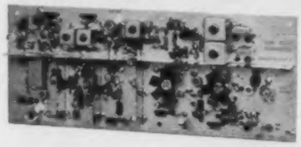
These Low Cost SSB TRANSMITTING CONVERTERS

Let you use inexpensive recycled 10M or 2M SSB exciters on UHF & VHF!

- Linear Converters for SSB, CW, FM, etc.
- A fraction of the price of other units; no need to spend $300 – $400!
- Use with any exciter; works with input levels as low as 1 mW.
- Use low power tap on exciter or simple resistor attenuator pad (instructions included).
- Link osc with RX converter for transceive.



XV4 UHF KIT — ONLY $99.95

28-30 MHz in, 435-437 MHz out; 1W p.e.p. on ssb, up to 1½W on CW or FM. Has second oscillator for other ranges. Atten. supplied for 1 to 500 mW input, use external attenuator for higher levels.

Extra crystal for 432-434 MHz range............$5.95
XV4 Wired and tested $149.95

XV2 VHF KIT - ONLY $69.95

2W p.e.p. output with as little as 1mW input. Use simple external attenuator. Many freq. ranges available.

MODEL	INPUT (MHz)	OUTPUT (MHz)
XV2-1	28-30	50-52
XV2-2	28-30	220-222
XV2-4	28-30	144-148
XV2-5	28-29 (27-27.4 CB)	145-146 (144-144.4)
XV2-7	144-146	50-52

XV2 Wired and tested $109.95

XV28 2M ADAPTER KIT - $24.95

Converts any 2M exciter to provide the 10M signal required to drive above 220 or 435 MHz units.

hamtronics TRANSMITTING CONVERTER
RF OUT

NEW! COMPLETE TRANSMITTING CONVERTER AND PA IN ATTRACTIVE CABINET

Far less than the cost of many 10W units!

Now, the popular Hamtronics® Transmitting Converters and heavy duty Linear Power Amplifiers are available as complete units in attractive, shielded cabinets with BNC receptacles for exciter and antenna connections. Perfect setup for versatile terrestial and OSCAR operations! Just right for phase 3! You save $30 when you buy complete unit with cabinet under cost of individual items. Run 40-45 Watts on VHF or 30-40 Watts on UHF with one integrated unit! Call for more details.

MODEL	KIT	WIRED and TESTED
XV2/LPA2-45/Cabt (6M or 2M)	$199.95	$299.95
XV4/LPA4-30/Cabt (for UHF)	$229.95	$349.95

Easy to Build FET RECEIVING CONVERTERS

Let you receive OSCAR and other exciting VHF and UHF signals on your present HF or 2M receiver

hamtronics RECEIVING CONVERTER
RCVR
PWR
ANT

- NEW LOW-NOISE DESIGN
- ATTRACTIVE WOODGRAIN CASE
- Less than 2dB noise figure, 20dB gain

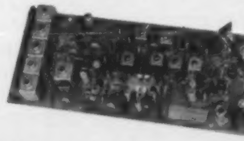
MODEL	RF RANGE	OUTPUT RANGE
CA28	28-32 MHz	144-148 MHz
CA50	50-52	28-30
CA50-2	50-54	144-148
CA144	144-146	28-30
CA145	145-147–or– 144-144.4	28-30 27-27.4 (CB)
CA146	146-148	28-30
CA220	220-222	28-30
CA220-2	220-224	144-148
CA110	Any 2MHz of Aircraft Band	26-28 or 28-30
CA432-2	432-434	28-30
CA432-5	435-437	28-30
CA432-4	432-436	144-148

Easily modified for other rf and if ranges.

STYLE	VHF	UHF
Kit less case	$34.95	$49.95
Kit with case	$39.95	$54.95
Wired/Tested in case	$54.95	$64.95

Professional Quality VHF/UHF FM/CW EXCITERS

- Fully shielded designs
- Double tuned circuits for spurious suppression
- Easy to align with built-in test aids



T50-50	6-chan, 6M, 2W Kit	$44.95
T50-150	6-chan, 2M, 2W Kit	$44.95
T50-220	6-chan, 220 MHz, 2W Kit	$44.95
T450	1-chan, 450 MHz, ¾W Kit	$44.95

See our Complete Line of VHF & UHF Linear PA's

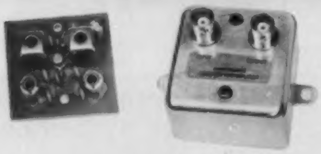
- Use as linear or class C PA
- For use with SSB Xmtg Converters, FM Exciters, etc.

LPA2-15	6M, 2M, 220; 15 to 20W	$59.95
LPA2-30	6M, 2m; 25 to 30W	$89.95
LPA2-40	220 MHz; 30 to 40W	$119.95
LPA2-45	6M, 2M; 40 to 45W	$119.95
LPA4-10	430MHz; 10 to 14W	$79.95
LPA4-30	430MHz; 30-40W	$119.95

See catalog for complete specifications

FAMOUS HAMTRONICS PREAMPS

Let you hear the weak ones too!
Great for OSCAR, SSB, FM, ATV. Over 14,000 in use throughout the world on all types of receivers.



- NEW LOW-NOISE DESIGN
- Less than 2 dB noise figure, 20 dB gain
- Case only 2 inches square
- Specify operating frequency when ordering

MODEL P-30 VHF PREAMP, available in many versions to cover bands 18-300 MHz.

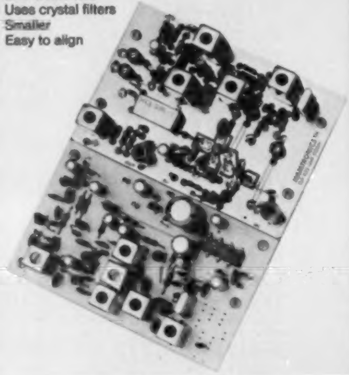
MODEL P432 UHF PREAMP, available in versions to cover bands 300-650 MHz.

STYLE	VHF	UHF
Kit less case	$12.95	$18.95
Kit with case	$18.95	$26.95
Wired/Tested in Case	$27.95	$32.95

NEW VHF/UHF FM RCVRS

Offer Unprecedented Range of Selectivity Options

- New generation
- More sensitive
- More selective
- Low cross mod
- Uses crystal filters
- Smaller
- Easy to align



R75A* VHF Kit for monitor or weather sattelite service. Uses wide L-C filter. -60dB at ± 30 kHz........$69.95

R75B* VHF Kit for normal nbfm service. Equivalent to most transceivers. -60dB at ± 17 kHz, -80dB at ± 25 kHz...$74.95

R75C* VHF Kit for repeater service or high rf density area. -60dB at ±14kHz, -80dB ±22kHz, -100dB ±30kHz....$84.95

R75D* VHF Kit for split channel operation or repeater in high density area. Uses 8-pole crystal filter. -60dB at ±9 kHz, -100dB at ± 15 kHz. The ultimate receiver!...$99.95

* Specify band: 10M, 6M, 2M, or 220 MHz. May also be used for adjacent commercial bands. Use 2M version for 137 MHz WX satellites.

R450( ) UHF FM Receiver Kits, similar to R75, but for UHF band. New low-noise front end. Add $10 to above prices. (Add selectivity letter to model number as on R75.)

A14 5 Channel Adapter for Receivers.............$9.95

NEW R110 VHF AM RCVR

AM monitor receiver kit similar to R75A, but AM. Available for 10-11M, 6M, 2M, 220 MHz, and 110-130 MHz aircraft band $74.95. (Also available in UHF version.)

IT'S EASY TO ORDER! ✓33

- Write or phone 716-392-9430
(Electronic answering service evenings & weekends)
- Use Credit Card, UPS COD, Check, Money Order
- Add $2.00 shipping & handling per order

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With Complete Details
(Send 4 IRC's for overseas mailing)

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NO ORDERS WILL BE ACCEPTED UNDER $10.00, NOT INCLUDING SHIPPING!
NO C.O.D.'s. PHONE IN YOUR ORDER

NEW PRIME RF POWER TRANSISTORS

2N2270	$ 1.00
2N2857	1.57
2N2857JAN	2.54
2N2947	17.25
2N3227	3.25
2N3261	2.32
2N3375/MM3375	9.32
2N3553	1.80
2N3818	8.00
2N3866	1.20
2N3866JAN	2.80
2N3866JANTX	4.49
2N3925/M9477	8.00
2N3948	2.00
2N3950	26.86
2N3959	3.88
2N4072	2.00
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2N4429	9.00
2N4877	1.00
2N4959	2.23
2N5108	4.03
2N5109	1.66
2N5179	1.05
2N5177/MRF5177	21.62
2N5214	20.00
2N5583	4.55
2N5589	6.83
2N5590	8.15
2N5591	11.85
2N5635	6.86
2N5636	13.38
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2N5641/PT4132D	6.00
2N5642	12.38
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2N5645	12.38
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2N5847	11.15
2N5919	30.00
2N5946	14.69
2N5849/MM1620	21.29
2N5862	51.91
2N6080	7.74
2N6082	11.30
2N6083	13.23
2N6084	14.66
2N6094	$ 7.15
2N6095	11.77
2N6097	29.54
2N6166	38.60
2N6368	26.52
2N6439	45.77
40280	3.00
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40282	12.90
40894	1.20
PT3551C/2N6082NS (no stud)	5.00
PT3563	5.00
PT4571A	1.50
PT3607	5.00
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MRF216	22.46
MRF221	10.08
MRF227	3.00
MRF238	10.00
MRF240	14.62
MRF245	33.30
MRF247	33.30
MRF314	14.08
MRF412	23.83
MRF421	31.38
MRF422A	44.14
MRF426A	10.24
MRF432	11.23
MRF449A	10.61
MRF450	11.77
MRF450A	11.77
MRF452	15.00
MRF452A	15.00
MRF454	21.83
MRF454A	21.83
MRF455	14.08
MRF455A	14.08
MRF474	3.00
MRF475	3.25
MRF476	2.25
MRF477	10.06
MRF479	4.68
MRF485	3.50
MRF502	1.08
MRF604	2.00
MRF629	3.00
MRF901	$ 3.99
MRF902	12.55
MRF904	3.00
MRF911	4.29
MRF5177	21.62
MRF8004	1.60
CD3495	19.99
CD3435	29.95
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MWA110	6.92
MWA120	7.38
MWA130	8.08
MWA210	7.46
MWA220	8.08
MWA230	8.62
MWA310	8.08
MWA320	8.62
MWA330	9.23

MICROWAVE DIODES

IN21	$ 2.85
IN21B	3.85
IN21D	3.85
IN21WE	2.85
IN23CR	4.85
IN23F	5.50
IN23WE	4.00
IN23FMR	6.95
IN25	6.50
IN78	8.63
IN446	12.00
IN3655A	3.85
IN5711/2835	1.99
MBD101	1.99
MBI101	4.99
IS1544A	3.00
P40075	3.85
IN41SEMR	7.85
MA41482	3.00
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MOTOROLA RF MODULES
MHW602
20 W output at 174 MHz
12.5 VDC 20.6 dB Gain
$42.00

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HAM MICROWAVE RECEIVERS
2100-2400 MHz
28 dB Gain
2.5 to 3 dB Noise

Assembled and tested with 90 day guarantee $269.95
$5.00 shipping with charge card or money order.

RECEIVER KIT $169.95 Includes Yagi antenna, power supply box, P.C.B. and parts, down converter P.C.B. and parts, and complete instructions.

MISCELLANEOUS PARTS FOR HMR	
Yagi antenna	$ 59.95
Power supply box	12.95
Power supply P.C.B.	4.99
Power supply transformer	3.99
Power supply kit	49.95
Power supply assembled and tested	59.95
Down converter P.C.B.	19.95
Down converter kit	79.95
Down converter assembled and tested	114.95
Complete Instructions	10.00
MRF901	3.99
MRF902	12.50
MRF911	4.29
7812	1.99
MBD101	1.99
MB1101	4.99
2835/1N5711	1.99
1 K Pot	3.00
Matching transformers, 75 Ohm - 300 Ohm	1.99
Two-way splitters	2.99
Chassis type F connectors	2/.99
Cable type F connectors	4/.99
Barrel type F connectors	.76
One 6 foot RG59 with connectors and one 50 foot RG59 with connectors	18.99

QUANTITY PRICES AVAILABLE FOR 10 AND UP

TUBES		12BY7A	$ 4.50
2E26	$ 5.00	811A	12.95
3-500Z	100.00	6146	5.00
3B28	7.00	6146A	5.25
3X2500A3	125.00	6146B	7.95
3X3000F1	200.00	6146W	12.95
4-65A	30.00	6360	7.95
4-125A	40.00	6939	8.00
4-250A	60.00	8072	45.00
4-400A	80.00	8295/PL172	300.00
4-1000A	200.00	8950	10.00
4CX250B	43.00	8877 OUT	300.00
4CX250R	45.00	7289	6.99
4CX350A	50.00	6KD6	6.00
4CX1000A	150.00	6LF6	6.00
4X150A	20.00	6LQ6/6JE6	6.00
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572B/T160L	39.00	6550A	8.00

Other numbers on request

NEW ELECTRICAL POWER STRIP
9 OUTLETS WITH BUILT IN CIRCUIT BREAKER AND INDICATOR LAMP
$21.95 each

Check, money order, or credit cards. (MasterCharge and VISA only) NO C.O.D.'s. No personal checks or certified personal checks for foreign countrys accepted. Money order or cashier's check in U.S. funds only. Letters of credit are not acceptable. Minimum shipping by UPS is $2.00 plus 35¢ insurance per $100.00. Please allow extra shipping charges for heavy items. All parts returned due to customer error will be subject to a 15% restock charge.

If we are out of an item ordered we will try to replace it with an equal or better part unless you specify not to, or we will back order the item. PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE. Prices superseade all previously published. Some items offered are limited to small quantities and are subject to prior sale. FOR OUT OF STATE USE OUR NEW 800 NUMBER FOR PHONE ORDERS. 800 528-3611 (For charge orders only, NO C.O.D.)

Low Cost...High Performance

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DM-700
18.00
FUNCTION
RANGE
PROBE
ramsey electronics

$99.95 WIRED

Low cost, high performance, that's the DM-700. Unlike some of the hobby grade DMMs available, the DM-700 offers professional quality performance and appearance at a hobbyist price. It features 26 different ranges and 5 functions, all arranged in a convenient, easy to use format. Measurements are displayed on a large 3½ digit, ½ inch high LED display, with automatic decimal placement, automatic polarity, and overrange indication. You can depend upon the DM-700, state-of-the-art components such as a precision laser trimmed resistor array, semiconductor band gap reference, and reliable LSI circuitry insure lab quality performance for years to come. Basic DC volts and ohms accuracy is 0.1%, and you can measure voltage all the way from 100 μv to 1000 volts, current from 0.1 μa to 2.0 amps and resistance from 0.1 ohms to 20 megohms. Overload protection is inherent in the design of the DM-700, 1250 volts, AC or DC on all ranges, making it virtually goof proof. Power is supplied by four 'C' size cells, making the DM-700 portable, and, as options, a nicad battery pack and AC adapter are available. The DM-700 features a handsome, jet black, rugged ABS case with convenient retractable tilt bail. All factory wired units are covered by a one year limited warranty and kits have a 90 day parts warranty.

Order a DM-700, examine it for 10 days, and if you're not satisifed in every way, return it in original form for a prompt refund.

Specifications

DC and AC volts:	100 μV to 1000 Volts, 5 ranges
DC and AC current:	0.1 μA to 2.0 Amps, 5 ranges
Resistance:	0.1Ω to 20 megohms, 6 ranges
Input protection:	1250 volts AC/DC all ranges fuse protected for overcurrent
Input impedance:	10 megohms, DC/AC volts
Display:	3½ digits, 0.5 inch LED
Accuracy:	0.1% basic DC volts
Power:	4 'C' cells, optional nicad pack, or AC adapter
Size:	6"W x 3"H x 6"D
Weight:	2 lbs with batteries

Prices

DM-700 wired + tested	$99.95
DM-700 kit form	79.95
AC adapter/charger	4.95
Nicad pack with AC adapter/charger	14.95
Probe kit	3.95

TERMS: Satisfaction guaranteed or money refunded, COD, add $1.50. Minimum order $6.00. Orders under $10.00, add $.75. Add 5% for postage, insurance, handling. Overseas, add 15%. NY residents, add 7% tax.

master charge
BANKAMERICARD VISA

600 mHz COUNTER

5242881
GATE
RANGE
CT-70 counter
ramsey electronics

$99.95 WIRED

The CT-70 breaks the price barrier on lab quality frequency counters. No longer do you have to settle for a kit, half-kit or poor performance, the CT-70 is completely wired and tested, features professional quality construction and specifications, plus is covered by a one year warranty. Power for the CT-70 is provided by four 'AA' size batteries or 12 volts, AC or DC, available as options are a nicad battery pack, and AC adapter. Three selectable frequency ranges, each with its own pre-amp, enable you to make accurate measurements from less than 10 Hz to greater than 600 mHz. All switches are conveniently located on the front panel for ease of operation, and a single input jack eliminates the need to change cables as different ranges are selected. Accurate readings are insured by the use of a large 0.4 inch seven digit LED display, a 1.0 ppm TCXO time base and a handy LED gate light indicator.

The CT-70 is the answer to all your measurement needs, in the field, in the lab, or in the ham shack. Order yours today, examine it for 10 days, if you're not completely satisfied, return the unit for a prompt and courteous refund.

Specifications

Frequency range:	10 Hz to over 600 mHz
Sensitivity:	less than 25 mv to 150 mHz less than 150 mv to 600 mHz
Stability:	1.0 ppm, 20-40°C, 0.05 ppm/°C TCXO crystal time base
Display:	7 digits, LED, 0.4 inch height
Input protection:	50 VAC to 60 mHz, 10 VAC to 600 mHz
Input impedance:	1 megohm, 6 and 60 mHz ranges 50 ohms, 600 mHz range
Power:	4 'AA' cells, 12 V AC/DC
Gate:	0.1 sec and 1.0 sec LED gate light
Decimal point:	Automatic, all ranges
Size:	5"W x 1½"H x 5½"D
Weight:	1 lb with batteries

Prices

CT-70 wired + tested	$99.95
CT-70 kit form	75.95
AC adapter	4.95
Nicad pack with AC adapter/charger	9.95
Telescopic whip antenna BNC plug	7.95
Tilt bail assembly	3.95

ramsey electronics

✓62 **BOX 4072, ROCHESTER, N.Y. 14610**
PHONE ORDERS CALL
(716) 271-6487

ATTENTION IC-2A OWNERS:

IC-2A TONE DECKS ARE HERE!

CUSTOM DESIGNED TO FIT WITH NO TROUBLE!

IT'S HERE NOW!

The question used to be, "When is Icom coming out with a hand-held?"...Now that it's become one of the hottest two meter rigs around, the big question now is, "When will a subaudible tone option be available for my IC-2A?" The answer is : Spectronics has it now!

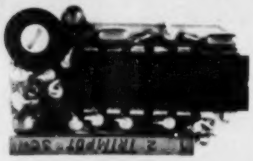
FULLY TUNABLE!

We are proud to be first in offering you a fully tunable miniature sub-audible tone deck specifically designed to fit the Icom IC-2A hand-held transceiver. If you own one of the other synthesized hand helds, you'll be delighted to know that you can put it in your unit as well.

QUALITY TO LAST!

This unit is manufactured by Transcom, Inc., to their exacting standards, and is guaranteed to be stable to within ± 1 Hz, after proper tuning. All units are pre-set to your specified tone, and require no further adjustment for freqency.

ANOTHER SPECTRONICS FIRST!



TOP VIEW

SIDE VIEW

- Fits plain or TT.
- Fully tunable! No tone elements to buy - ever!
- Also fits other synthesized handhelds as well.
- Easy to install; no cutting, chopping, or remote parts!
- Accurate to ± 1 Hz.

$29.95 Plus $2.00 S & H

master charge VISA

PHONE: (312) 848-6777

SPECTRONICS, INC. — 1009 GARFIELD ST.
OAK PARK, ILL.-60304 ✓67

AZDEN ★ NEW! ★ AZDEN ★ NEW! ★ AZDEN ★ NEW! ★ AZDEN

THE GIANT AZDEN® COMPANY

REVOLUTIONIZES THE STATE OF THE ART

AWE AND AZDEN. INTRODUCE THE BRILLIANT NEW PCS-2800

MICROCOMPUTER CONTROLLED

SUPERIOR COMMERCIAL GRADE

10 METER

FM TRANSCEIVER

INTRODUCTORY PRICE

$299.00

AZDEN
10M FM TRANSCEIVER
PCS-2800
9.00
MHz
S/RF
UL
MAIN
MEMORY ADDRESS
POWER/VOL
RF ATT/SQL
HIGH/LOW
VOL&SQL
INT/EXT
100K UP
10K UP
100K DOWN
10K DOWN
MAIN
M ADRS
M SCAN
M1 CALL
M CALL
SCAN MODE
SLOW
NORMAL
MIC/CONT

COMPARE THESE FEATURES WITH ANY UNIT AT ANY PRICE

- **FREQUENCY RANGE:** Receive and transmit: 28.000 to 29.995 MHz, 10KHz steps with built-in + 100 KHz repeater offset.
- **ALL SOLID STATE-CMOS PL DIGITAL SYNTHESIZED.**
- **SIZE:** UNBELIEVABLE! **ONLY** 6 3/4" x 2 3/8" x 9 3/4". **COMPARE!**
- **MICROCOMPUTER CONTROLLED:** All scanning and frequency-control functions are performed by microcomputer.
- **DETACHABLE HEAD:** The control head may be separated from the radio for use in limited spaces and for security purposes.
- **SIX-CHANNEL MEMORY:** Each memory is re-programmable. Memory is retained even when the unit is turned off.
- **MEMORY SCAN:** The six channels may be scanned in either the "busy" or "vacant" modes for quick, easy location of an occupied or unoccupied frequency. AUTO RESUME. **COMPARE!**
- **FULL-BAND SCAN:** All channels may be scanned in either "busy" or "vacant" mode. This is especially useful for locating repeater frequencies in an unfamiliar area. AUTO RESUME. **COMPARE!**
- **INSTANT MEMORY-1 RECALL:** By pressing a button on the microphone or front panel, memory channel 1 may be recalled for immediate use.
- **MIC-CONTROLLED VOLUME AND SQUELCH:** Volume and squelch can be adjusted from the microphone for convenience in mobile operation.
- **DIRECT FREQUENCY READOUT:** LED display shows operating frequency, **NOT** channel number. **COMPARE!**
- **TEN (10) WATTS OUTPUT:** Also 1 watt low power for shorter distance communications. LED readout displays power selection when transmitting.
- **DIGITAL S/RF METER:** LEDs indicate signal strength and power output. No more mechanical meter movements to fall apart!
- **LARGE ½-INCH LED DISPLAY:** Easy-to-read frequency display minimizes "eyes-off-the-road" time.
- **PUSHBUTTON FREQUENCY CONTROL FROM MIC OR FRONT PANEL:** Any frequency may be selected by pressing a microphone or front-panel switch.
- **SUPERIOR RECEIVER SENSITIVITY:** 0.28 uV for 20-dB quieting. The squelch sensitivity is superb, requiring less than 0.1 uV to open. The receiver audio circuits are designed and built to exacting specifications, resulting in unsurpassed received-signal intelligibility.
- **TRUE FM, NOT PHASE MODULATION:** Transmitted audio quality is optimized by the same high standard of design and construction as is found in the receiver. The microphone amplifier and compression circuits offer intelligibility second to none.
- **OTHER FEATURES:** Dynamic Microphone, built in speaker, mobile mounting bracket, external remote speaker jack (head and radio) and much, much more. All cords, plugs, fuses, microphone hanger, etc. included. Weight 6 lbs.
- **ACCESSORIES:** 15' REMOTE CABLE....$29.95. FMPS-4R A/C POWER SUPPLY....$39.95. TOUCHTONE MIC. KIT....$39.95. EXTERNAL SPEAKER....$18.00.

AMATEUR-WHOLESALE ELECTRONICS ORDER NOW TOLL FREE

8817 S.W. 129th Terrace, Miami, Florida 33176
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✓ 62

PARTS WAREHOUSE

We now have available a bunch of goodies too good to bypass. Items are limited so order today

PO BOX 10101
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716-381-7265

Call Your Phone Order in Today

TERMS: Satisfaction guaranteed or money refunded. COD add $1.50. Minimum order $6.00. Orders under $10.00 add $.75. Add 5% for postage, insurance, handling. Overseas add 15%. NY residents add 7% tax.

MINI KITS - YOU HAVE SEEN THESE BEFORE NOW HERE ARE OLD FAVORITE AND NEW ONES TOO. GREAT FOR THAT AFTERNOON HOBBY.

FM MINI MIKE

A super high performance FM wireless mike kit! Transmits a stable signal up to 300 yards with exceptional audio quality by means of its built in electret mike. Kit includes case, mike, on-off switch, antenna, battery and super instructions. This is the finest unit available.

FM-3 Kit	$14.95
FM-3 Wired and Tested	19.95

Color Organ

See music come alive! 3 different lights flicker with music. One light each for, high, mid-range and lows. Each individually adjustable and drives up to 300 W. runs on 110 VAC.

Complete kit, ML-1
$8.95

Video Modulator Kit

Converts any TV to video monitor. Super stable, tunable over ch. 4-6. Runs on 5-15V, accepts std. video signal. Best unit on the market! Complete kit, VD-1 $7.95

Led Blinky Kit

A great attention getter which alternately flashes 2 jumbo LEDs. Use for name badges, buttons, warning panel lights, anything! Runs on 3 to 15 volts.
Complete kit, BL-1
$2.95

Super Sleuth

A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2 W rms output, runs on 6 to 15 volts, uses 8-45 ohm speaker.
Complete kit, BN-9 $5.95

CPO-1

Runs on 3-12 Vdc 1 wall out, 1 KHZ good for CPO, Alarm, Audio Oscillator. Complete kit $2.95

FM Wireless Mike Kit

Transmits up to 300' to any FM broadcast radio, uses any type of mike. Runs on 3 to 9V. Type FM-2 has added sensitive mike preamp stage.

FM-1 kit $3.95 FM-2 kit $4.95

Whisper Light Kit

An interesting kit, small mike picks up sounds and converts them to light. The louder the sound, the brighter the light. Includes mike, controls up to 300 W, runs on 110 VAC.
Complete kit, WL-1
$6.95

Tone Decoder

A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20 turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 $5.95

Universal Timer Kit

Provides the basic parts and PC board required to provide a source of precision timing and pulse generation. Uses 555 timer IC and includes a range of parts for most timing needs.

UT-5 Kit $5.95

Mad Blaster Kit

Produces LOUD ear shattering and attention getting siren like sound. Can supply up to 15 watts of obnoxious audio. Runs on 6-15 VDC.

MB-1 Kit $4.95

Siren Kit

Produces upward and downward wail characteristic of a police siren. 5 W peak audio output, runs on 3-15 volts, uses 3-45 ohm speaker.
Complete kit, SM-3 $2.95

60 Hz Time Base

Runs on 5-15 VDC. Low current (2.5ma). 1 min/month accuracy TB-7 Kit $5.50
TB-7 Assy $9.95

CLOCK KITS

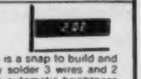
Your old favorites are here again. Over 7,000 Sold to Date. Be one of the gang and order yours today!

Try your hand at building the finest looking clock on the market. Its satin finish anodized aluminum case looks great anywhere, while six .4" LED digits provide a highly readable display. This is a complete kit, no extras needed, and it only takes 1-2 hours to assemble. Your choice of case colors: silver, gold, black (specify).

Clock kit, 12/24 hour, DC-5	$24.95
Clock with 10 min. ID timer, 12/24 hour, DC-10	$29.95
Alarm clock, 12 hour only, DC-8	$29.95
12V DC car clock, DC-7	$29.95

For wired and tested clocks add $10.00 to kit price.
SPECIFY 12 OR 24 HOUR FORMAT

Car Clock



The UN-KIT, only 5 solder connections

Here's a super looking, rugged and accurate auto clock, which is a snap to build and install. Clock movement is completely assembled — you only solder 3 wires and 2 switches, takes about 15 minutes! Display is bright green with automatic brightness control photocell — assures you of a highly readable display, day or night. Comes in a satin finish anodized aluminum case which can be attached 5 different ways using 2 sided tape. Choice of silver, black or gold case (specify).

DC-3 kit, 12 hour format	$22.95
DC-3 wired and tested	$29.95

Calendar Alarm Clock

The clock that's got it all: 6-.5" LEDs, 12/24 hour, snooze, 24 hour alarm, 4 year calendar, battery backup, and lots more. The super 7001 chip is used. Size: 5x4x2 inches. Complete kit, less case (not available)
DC-9 $34.95

Under Dash Car Clock

12/24 hour clock in a beautiful plastic case features 6 jumbo RED LEDS, high accuracy (.001%), easy 3 wire hookup, display blanks with ignition, and super instructions. Optional dimmer automatically adjusts display to ambient light level.

DC-11 clock with mtg. bracket	$27.95 kit
DM-1 dimmer adapter	$2.50

Add $10.00 Assy. and Test

Video Terminal

A completely self-contained, stand alone video terminal card. Requires only an ASCII keyboard and TV set to become a complete terminal unit. Features are: single 5V supply, XTAL controlled sync and baud rates (to 9600), complete computer and keyboard control of cursor. Parity error control and display. Accepts and generates serial ASCII plus parallel keyboard input. The 6416 is 64 char. by 16 lines with scrolling, upper and lower case (optional) and has RS-232 and 20ma loop interfaces on board. Kits include sockets and complete documentation.

RE 6416 terminal card kit (add $60.00 for wired unit)	$189.95
Lower Case option	$13.95
Power Supply	$14.95
RF Modulator kit	$7.95

PARTS PARADE

IC SPECIALS

LINEAR

301	$ .35
324	$1.50
380	$1.50
555	$ .45
556	$1.00
565	$1.00
566	$1.00
567	$1.25
741	10/$2.00
1458	$ .50
3900	$ .50
3914	$2.95
8038	$2.95

TTL

74S00	$ .40
7447	$ .65
7475	$ .50
7490	$ .50
74196	$1.35

SPECIAL

11C90	$15.00
10116	$ 1.25
7208	$17.50
7207A	$ 5.50
7216D	$21.00
7107C	$12.50
5314	$ 2.95
5375AB/G	$ 2.95
7001	$ 6.50

CMOS

4011	.50
4013	.50
4046	$1.85
4049	.50
4059	$9.00
4511	$2.00
4518	$1.35
5639	$1.75

FERRITE BEADS

With info and specs	15/$1.00
6 Hole Balun Beads	5/$1.00

READOUTS

FND 359 .4" C C	$1.00
FND 507/510 .5" C A	1.00
MAN 72/HP7730 .33" C A	1.00
HP 7651 .43" C A	2.00

Sockets

8 Pin	10/$2.00
14 Pin	10/$2.00
16 Pin	10/$2.00
24 Pin	4/$2.00
28 Pin	4/$2.00
40 Pin	3/$2.00

TRANSISTORS

2N3904 NPN	15/$1.00
2N3906 PNP	15/$1.00
2N4403 PNP	15/$1.00
2N4410 NPN	15/$1.00
2N4916 FET	4/$1.00
2N5401 PNP	5/$1.00
2N6028 C+F	4/$1.00
2N3771 NPN Silicon	$1.50
2N5179 UHF NPN	3/$2.00
Power Tab NPN 40W	3/$1.00
Power Tab PNP 40W	3/1.00
MPF 102/2N5484	$.50
NPN 3904 Type	50/$2.50
PNP 3906 Type	50/$2.50
2N3055	$.60
2N2646 UJT	3/$2.00

Diodes

5.1 V Zener	20/$1.00
1N914 Type	50/$1.00
1KV 2Amp	8/$1.00
100V 1Amp	15/$1.00

25 AMP
100V Bridge
$1.50 each

Mini-Bridge 50V
1 AMP
2 for $1.00

Resistor Ass't

Assortment of Popular values - ¼ watt. Cut lead for PC mounting, ½" center, ½" leads, bag of 300 or more. $1.50

Crystals

3.579545 MHZ	$1.50
10.00000 MHZ	$5.00
5.248800 MHZ	$5.00

Switches

Mini toggle SPDT	$1.00
Red Pushbuttons N.O.	3/$1.00

Earphones

3" leads, 8 ohm, good for small tone speakers, alarm clocks, etc.
5 for $1.00

AC Adapters

Good for clocks, nicad chargers, all 110 VAC plug one end

8.5 vdc @ 20 mA	$1.00
16 vac @ 160mA	$2.50
12 vac @ 250mA	$3.00

Mini 8 ohm Speaker

Approx 2¼" diam. Round type for radios, mike etc.
3 for $2.00

Solid State Buzzers

small buzzer 450 Hz, 86 dB, sound output on 5-12 vdc at 10-30 mA, TTL compatible $1.50

Slug Tuned Coils

Small 3/16" Hex Slugs turned coil. 3 turns. 10 for $1.00

AC Outlet

Panel Mount with Leads
4/$1.00

CAPACITORS

TANTALUM Dipped Epoxy		ALUMINUM Electrolytic		DISK CERAMIC	
1.5 uF 25V	3/$1.00	1000 uF 16V Radial	$.50	.01 16V disk	20/$1.00
1.8 uF 25V	3/$1.00	500 uF 20V Axial	$.50	.1 16V	15/$1.00
.22 uF 25V	3/$1.00	150 uF 16V Axial	5/$1.00	.001 16V	20/$1.00
		10 uF 15V Radial	10/$1.00	100 pF	20/$1.00
				.047 16V	20/$1.00

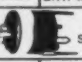
DC-DC Converter

+5 vdc input prod. -9 vdc @ 30ma
+9 vdc produces -15 vdc @ 35ma $1.25

Ceramic IF Filters

Mini ceramic filters 7 kHz B.W. 455 kHz $1.50 ea.

25K 20 Turn Trim Pot	$1.00
1K 20 Turn Trim Pot	$ .50



Trimmer Caps

Sprague - 3-40 pf
Stable Polypropylene
.50 ea.

Crystal Microphone

Small 1" diameter ¼" thick crystal mike cartridge $.75

Mini RG-174 Coax
10 ft. for $1.00

Coax Connector

Chassis mount
BNC type $1.00

9 Volt Battery Clips

Nice quality clips	5 for $1.00
¼" Rubber Grommets	10 for $1.00

Parts Bag

Asst. of chokes, disc. caps, tant., resistors, transistors, diodes, MICA caps etc.
sm. bag (100 pc) $1.00 lg. bag (300 pc) $2.50

Connectors

6 pin type gold contacts for mA-1003 car clock module
price .75 ea.

Leds - your choice, please specify

Mini Red, Jumbo Red, High Intensity Red, Illuminator Red	8/$1
Mini Yellow, Jumbo Yellow, Jumbo Green	6/$1

Varactors

Motorola MV 2209 30 PF Nominal cap 20-80 PF - Tunable range - .50 each or 3/$1.00

Audio Prescaler

Make high resolution audio measurments, great for musical instrument tuning, PL tones, etc. Multiplies audio UP in frequency, selectable x10 or x100, gives .01 HZ resolution with 1 sec. gate time! High sensitivity of 25 mv, 1 meg input z and built-in filtering gives great performance. Runs on 9V battery, all CMOS.

PS-2 kit	$29.95
PS-2 wired	$39.95

600 MHz PRESCALER

Extend the range of your counter to 600 MHz. Works with all counters. Less than 150 mv sensitivity. specify -10 or -100

Wired, tested, PS-1B	$59.95
Kit, PS-1B	$44.95

30 Watt 2 mtr PWR AMP

Simple Class C power amp features 8 times power gain. 1 W in for 8 out, 2 W in for 15 out, 4W in for 30 out. Max output of 35 W, incredible value, complete with all parts, less case and T-R relay.

PA-1, 30 W pwr amp kit	$22.95
TR-1, RF sensed T-R relay kit	6.95

MRF-238 transistor as used in PA-1
8-10db gain 150 mhz $11.95

RF actuated relay senses RF (1W) and closes DPDT relay.
For RF sensed T-R relay
TR-1 Kit $6.95

Power Supply Kit

Complete triple regulated power supply provides variable 6 to 18 volts at 200 ma and +5 at 1 Amp. Excellent load regulation, good filtering and small size. Less transformers, requires 6.3 V @ 1 A and 24 VCT.
Complete kit, PS-3LT $6.95

OP-AMP Special

BI-FET LF 13741 - Direct pin for pin 741 compatible, but 500,000 MEG input z, super low 50 pa input current, low power drain.

50 for only $9.00 **10 for $2.00**

Regulators

78MG	$1.25	7812	$1.00
79MG	$1.25	7815	$1.00
723	$.50	7905	$1.25
309K	$1.15	7912	$1.25
7805	$1.00	7915	$1.25

Shrink Tubing Nubs

Nice precut pces of shrink size 1" x ¼" shrink to ⅛". Great for splices. 50/$1.00

Mini TO-92 Heat Sinks

Thermalloy Brand	5 for $1.00
To-220 Heat Sinks	3 for $1.00

Opto Isolators - 4N28 type	$.50 ea.
Opto Reflectors - Photo diode + LED	$1.00 ea.

Molex Pins

Molex already precut in length of 7. Perfect for 14 pin sockets. 20 strips for $1.00

CDS Photocells

Resistance varies with light. 250 ohms to over 3 meg. 3 for $1.00

✓ *Reader Service—see page 195*

THESE PRICES ARE NOT MISPRINTS

Here is a chance to stock up your lab at unprecendented prices... we've got to move these out to make room for our ever-expanding **CompuPro**™ division. **Limited quantities - first come, first served.** Sorry, at these low prices we cannot include spec sheets or accept COD/telephone orders. Part numbers **must** include the special -S suffix or you will be charged our regular prices. Parts may be house numbered or have dual markings. **This is your chance to save!**

TTL

7403-S	Quad 2 input OC	21/$2
7410-S	Triple 3 input NAND	21/$2
7413-S	4 to 16 line decoder/demux	6/$2
7436-S	Quad 2 input NAND OC	21/$2
7444-S	Gray to decimal decoder	8/$2
7450-S	And-or-invert	21/$2
7472-S	JK M-S flip flop	21/$2
7493-S	4 bit binary counter	10/$2
7496-S	5 bit shift register	12/$2
74122-S	Retriggerable one-shot	18/$2
74151-S	8 channel mux	8/$2
74155-S	Dual 2/4 demux	8/$2
74159-S	4 to 16 line decoder/demux OC	4/$2
74161-S	Synchro 4 bit binary counter	8/$2
74163-S	Synchro 4 bit binary counter	8/$2
74164-S	8 bit shift register	6/$2
74190-S	Up/down decade counter	4/$2
74192-S	Up/down binary counter	4/$2
74194-S	4 bit bidirectional shift reg	4/$2
74195-S	4 bit parallel shift register	6/$2
74198-S	8 bit shift register	4/$2

CMOS

4012-S	Dual 4 input NAND	12/$2
4020-S	14 stage counter	4/$2
4023-S	Triple 3 input NAND	12/$2
4044-S	Quad R-S latch	4/$2
4046-S	Phase locked loop	2/$2
4071-S	Quad 2 input OR	12/$2
4093-S	Quad 2 in NAND Schmitt trig	4/$2
4507-S	Quad EX-OR	4/$2
4510-S	BCD up/down counter	2/$2
5101-S	1024 bit stat. RAM 4 × 256	10/$12.50

LINEARS

(package type: H = T099, M = minidip, D = dip, TK = T066)

201H-S	Improved 301 op amp	10/$2
308H-S	Micropower op amp	6/$2
703H-S	RF/IF amp	8/$2
723D-S	Voltage regulator	6/$2
741M-S	Compensated op amp	15/$2
1458M-S	Dual 741	10/$2
4558M-S	Dual 741	12/$2
4195TK-S	Dual track 15V reg w/data	2/$2

TO-220 NEGATIVE VOLTAGE REGULATORS

7906-S	-6V regulator	2/$2
7908-S	-8V regulator	2/$2
7912-S	-12V regulator	2/$2
79M15-S	-15V regulator	2/$2
7918-S	-18V regulator	2/$2
7924-S	-24V regulator	2/$2

OTHER SEMICONDUCTORS

• General purpose silicon signal diodes	50/$2
• GT5306 NPN darlington, min gain 17000, 25V 200 mA, T092 package	100/$8.95
• NPN transistor similar 2N3904	100/$7.96
• PNP transistor similar 2N3906	100/$8.95
• 4N28-S opto-coupler 6 pin minidip, MCT-2/IL-1 pinout	5/$2
• SN76477-S complex sound generator	1/$2.50
• MA1003 12V DC clock module w/case	$19.95
• Opto-Isolator Grab Bag — 50 mixed opto-isolators from a major manufacturer. Unmarked 6 and 8 lead minidips include single and dual types with diode, transistor, and darlington outputs. Test them yourself and save! Not recommended for beginners.	50/$4

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

SOLDERTAIL SOCKET SPECIAL

Now that you've got the ICs, get some sockets at a fantastic price!

14 pin:	50/$4.95	20 pin:	40/$4.95
16 pin:	50/$4.95	24 pin:	30/$4.95
18 pin:	50/$4.95	28 pin:	30/$4.95
		40 pin:	20/$4.95

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

74LS TTL

74LS00	$0.34	74LS154	2.10
74LS01	0.34	74LS155	1.87
74LS02	0.34	74LS157	1.57
74LS04	0.38	74LS160	2.20
74LS05	0.44	74LS161	2.18
74LS08	0.34	74LS162	2.20
74LS10	0.34	74LS163	2.18
74LS11	0.40	74LS168	3.75
74LS12	0.34	74LS169	3.75
74LS14	2.20	74LS173	2.08
74LS15	0.40	74LS174	2.05
74LS20	0.34	74LS175	1.95
74LS21	0.40	74LS181	3.50
74LS22	0.40	74LS192	3.05
74LS26	0.48	74LS195	1.87
74LS27	0.42	74LS221	1.70
74LS30	0.34	74LS240	2.50
74LS32	0.46	74LS241	2.50
74LS33	0.60	74LS244	2.50
74LS37	0.48	74LS257	1.95
74LS38	0.48	74LS258	2.02
74LS42	1.56	74LS266	0.69
74LS47	1.68	74LS273	2.91
74LS48	1.68	74LS283	2.02
74LS74	0.54	74LS365	0.88
74LS75	0.82	74LS366	0.88
74LS76	0.50	74LS367	0.88
74LS86	0.58	74LS368	0.88
74LS109	0.62	74LS386	0.69
74LS123	1.70	80LS95	0.88
74LS125	0.67	80LS96	0.88
74LS126	0.67	80LS97	0.88
74LS132	1.50	80LS98	0.88
74LS136	0.69	81LS95	2.10
74LS138	1.87	81LS96	2.10
74LS139	1.87	81LS97	2.10
74LS151	1.66	81LS98	2.10

MORE TRANSISTORS AND FETS

2N2221	NPN TO-18 unmarked	7/$1.00
2N2222	PNP TO-18 unmarked	5/$1.00
2N2907A	PNP plastic house #	5/$1.00
2N3055	NPN TO-3 house #	1/$0.75
2N3904	NPN TO-105 house #	6/$1.00
2N3906	PNP TO-105 house #	5/$1.00
2N4124	30V/350 mW TO-92	3/$1.00
2N4304	TO-18 plastic N-JFET gen purp	2/$1.00
2N4400	NPN plastic house #	5/$1.00
2N4917	PNP TO-106	5/$1.00
2N4946	NPN TO-106	6/$1.00
2N5227	PNP TO-92 30V	6/$1.00
2N5306	NPN TO-92 darlington	3/$1.00
2N5449	NPN	6/$1.00
2N5484	RF N-JFET	3/$1.00
D41D1	PNP TO-202 1A max	1/$0.50
D44C4	NPN TO-220 4A/55V	1/$0.75
D45C4	PNP TO-220 4A/55V	1/$0.75
D45H8	PNP TO-220 10A/60V	3/$2.00
MPS3694	NPN gen purp	4/$1.00
FPT100	Phototransistor	1/$0.50
FET-2	Dual N-JFET TO-18 sim 2N4416	3/$1.00
FET-3	Dual N-JFET lo noise audio	2/$1.00
FET-6	Gen purp dual gate MOSFET house #	3/$2.00

POWER SUPPLY KITS

#HK-102 ½ AMP SUPPLY KIT $8.00

Regulated, short-proof, thermally limited. Half an Amp continuous or 1 Amp intermittent. Avoid the headache of designing your own; we've already collected all the parts and can save you $$$ too! Specify 5, 6, 8, or 12 Volts. Less case and hardware.

#HK-104 12V, 8A SUPPLY KIT $44.50

Handles 12A peaks with 50% duty cycle. Includes crowbar overvoltage protection, current limiting, adjustable output 11 - 14V, custom wound transformer, RF suppression, and easy assembly (all parts except transformer, filter cap, and diodes mount on the printed circuit board). Ideal for powering mobile transceivers and other automotive equipment in the home; also makes a dandy lab bench supply. Please allow $10 for shipping charges, excess will be refunded.

#13-XX BIPOLAR POWER SUPPLY KIT $15.00

Regulated, very simple assembly, virtually blow-out proof, delivers ¼ Amp minimum per side. Available in 5, 6, 8, 9, 12, and 15 Volt bipolar models — specify project #13-XX where XX stands for the desired voltage.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

16K DYNAMIC RAM SPECIAL: 8/$59!

Expand memory in TRS-80* -I and -II, as well as machines made by Apple, Exidy, Heath H89, newer PETs, etc. Low power, high speed (4 MHz). Add $3 for 2 dip shunts plus TRS-80* conversion instructions. Limited quantity.

*TRS-80 is a trademark of the Tandy Corporation.

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TERMS: Cal res add tax. Allow 5% for shipping; excess refunded. Orders under $15 add $1 handling. VISA®/Mastercard® orders ($25 min) call our 24 hour order desk at **(415) 562-0636**. COD OK with street address for UPS. **PLEASE NOTE: TELEPHONE ORDERS AND CODS ARE NOT ALLOWED ON SPECIALS LISTED ABOVE.** Sale prices good through cover month of magazine; other prices subject to change without notice.

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Bldg. 725, Oakland Airport, CA 94614

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free flyer

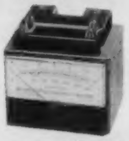
FREE FLYER: This ad is only the tip of the iceberg; our catalog tells the rest of the story. Add 41 cents in stamps for 1st class delivery. Outside USA, include $2 to cover postage (refundable with order). **Thank you for your business!**

SAVE! SAVE! SAVE!

new

ULTRAVIOLET INTENSITY METER

by BLAK-RAY



TWO MODELS:
LONG WAVE
AND
SHORT WAVE

Meter consists of a sensor cell attached to a compact (3" x 3¼" x 3") metering unit. Can be hand-held or placed directly on surface for measuring. Can be used remotely, while connected to a meter housing by a 4-foot extension cord. Two models available — one for long wave and one for short wave ultraviolet. Readings are in microwatts per square centimeter. Weight: 1 lb.

Completely assembled (includes sensor cell, reduction screen, extension cord, contrast filter and certification report.)

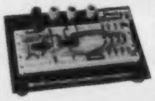
J-221 LONG WAVE (300nm-400nm) **$242.00**
J-225 SHORT WAVE (200nm-280nm) **$260.00**

CSC CONTINENTAL SPECIALTIES

Proto Clips

14-PIN CLIP	PC-14	$ 4.50
16-PIN CLIP	PC-16	$ 4.75
24-PIN CLIP	PC-24	$10.00
40-PIN CLIP	PC-40	$16.00

Proto Boards



PB-6	$17.95
PB-100	19.95
PB-101	22.95
PB-102	26.95
PB-103	44.95
PB-104	55.95
PB-203	99.95
PB-203A	165.00
PB-203A-Kit	131.00

Jumbo 6-Digit Clock Kit

- Four .630" ht. and two .300" ht. common anode displays
- Uses MM5314 clock chip
- Switches for hours, minutes and hold functions
- Hours easily viewable to 30 feet
- Simulated walnut case
- 115VAC operation
- 12 or 24 hour operation
- Includes all components, case and wall transformer
- Size: 6¾ x 3⅛ x 1¾

JE747 .... **$29.95**

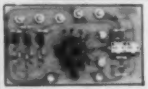
- Bright .300 ht. comm. cathode display
- Uses MM5314 clock chip
- Switches for hours, minutes and hold modes
- Hrs. easily viewable to 20 ft.
- Simulated walnut case
- 115 VAC operation
- 12 or 24 hr. operation
- Incl. all components, case & wall transformer
- Size: 6¾" x 3-1/8" x 1¾"

JE701
6-Digit Clock Kit $19.95

Regulated Power Supply

Uses LM309K. Heat sink provided. PC board construction. Provides a solid 1 amp @ 5 volts. Can supply up to ±5V, ±9V and ±12V with JE205 Adapter. Includes components, hardware and instructions. Size: 3½" x 5" x 2"H

JE200 .... **$14.95**



ADAPTER BOARD
—Adapts to JE200—
±5V, ±9V and ±12V

DC/DC converter with +5V input. Toriodal hi-speed switching XMFR. Short circuit protection. PC board construction. Piggy-back to JE 200 board. Size: 3½" x 2" x 9/16"H

JE205 .... **$12.95**

MICROPROCESSOR COMPONENTS

8080A/8085A SUPPORT DEVICES

8080A	CPU	$ 7.95
8212	8-Bit Input/Output	3.25
8214	Priority Interrupt Control	5.95
8216	Bi-Directional Bus Driver	3.49
8224	Clock Generator/Driver	3.95
8226	Bus Driver	3.49
8228	System Controller/Bus Driver	4.95
8238	System Controller	5.95
8251	Prog. Comm. I/O (USART)	7.95
8253	Prog. Interval Timer	14.95
8255	Prog. Periph. I/O (PPI)	9.95
8257	Prog. DMA Control	19.95
8259	Prog. Interrupt Control	19.95

6800/6800 SUPPORT DEVICES

MC6800	MPU	$14.95
MC6802CP	MPU with Clock and Ram	24.95
MC6810API	128X8 Static Ram	5.95
MC6821	Periph. Inter. Adapt (MC6820)	7.49
MC6828	Priority Interrupt Controller	12.95
MC6830L8	1024X8 Bit ROM (MC68A30-8)	14.95
MC6850	Asynchronous Comm. Adapter	7.95
MC6852	Synchronous Serial Data Adapt.	9.95
MC6860	0-600 bps Digital MODEM	12.95
MC6862	2400 bps Modulator	14.95
MC6880A	Quad 3-State Bus. Trans. (MC8T26)	2.25

MICROPROCESSOR CHIPS—MISCELLANEOUS

Z80(780C)	CPU	$13.95
Z80A(780-1)	CPU	15.95
CDP1802	CPU	19.95
2650	MPU	19.95
6502	CPU	11.95
8035	8-Bit MPU w/clock, RAM, I/O lines	19.95
P8085	CPU	19.95
TMS9900JL	16-Bit MPU w/hardware, multiply & divide	49.95

SHIFT REGISTERS

MM500H	Dual 25 Bit Dynamic	$.50
MM503H	Dual 50 Bit Dynamic	.50
MM504H	Dual 16 Bit Static	.50
MM506H	Dual 100 Bit Static	.50
MM510H	Dual 64 Bit Accumulator	.50
MM5016H	500/512 Bit Dynamic	.80
2504T	1024 Dynamic	3.95
2518	Hex 32 Bit Static	4.95
2522	Dual 132 Bit Static	2.95
2524	512 Static	.99
2525	1024 Dynamic	2.95
2527	Dual 256 Bit Static	2.95
2528	Dual 250 Static	4.00
2529	Dual 240 Bit Static	4.00
2532	Quad 80 Bit Static	2.95
3341	Fifo	6.95
74LS670	4X4 Register File (TriState)	2.49

UART'S

A-Y-5-1013	30K BAUD	5.95

MICROPROCESSOR MANUALS

M-Z80	User Manual	$7.50
M-CDP1802	User Manual	7.50
M-2650	User Manual	5.00

ROM'S

2513(2140)	Character Generator(upper case)	$9.95
2513(3021)	Character Generator(lower case)	9.95
2516	Character Generator	10.95
MM5230N	2048-Bit Read Only Memory	1.95

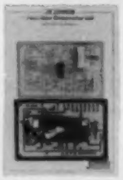
RAM'S

1101	256X1	Static	$1.49
1103	1024X1	Dynamic	.99
2101(8101)	256X4	Static	3.95
2102	1024X1	Static	1.75
21L02	1024X1	Static	1.95
2111(8111)	256X4	Static	3.95
2112	256X4	Static MOS	4.95
2114	1024X4	Static 450ns	7.95
2114L	1024X4	Static 450ns low power	10.95
2114-3	1024X4	Static 300ns	10.95
2114L-3	1024X4	Static 300ns low power	11.95
5101	256X4	Static	7.95
5280/2107	4096X1	Dynamic	4.95
7489	16X4	Static	1.75
74S200	256X1	Static Tristate	4.95
93421	256X1	Static	2.95
UPD414 (MK4027)	4K	Dynamic 16 pin	4.95
UPD416 (MK4116)	16K	Dynamic 16 pin 250ns	7.95
TMS4044-45NL	4K	Static	14.95
TMS4045	1024X4	Static	14.95
2117	16,384X1	Dynamic 350ns (house marked)	9.95
MM5262	2KX1	Dynamic	4/1.00

PROM'S

1702A	2048	FAMOS	$5.95
2716INTEL	16K*	EPROM	59.95
TMS2516 (2716)	16K*	EPROM	24.95
	*Requires single +5V power supply		
TMS2532	4KX8	EPROM	69.95
2708	8K	EPROM	10.95
2716 T.I	16K**	EPROM	29.95
	**Requires 3 voltages, −5V, +5V, +12V		
5203	2048	FAMOS	14.95
6301-1(7611)	1024	Tristate Bipolar	3.49
6330-1(7602)	256	Open C Bipolar	2.95
82S23	32X8	Open Collector	3.95
82S115	4096	Bipolar	19.95
82S123	32X8	Tristate	3.95
74186	512	TTL Open Collector	9.95
74188	256	TTL Open Collector	3.95
74S287	1024	Static	2.95

Function Generator Kit



Provides 3 basic waveforms: sine, triangle and square wave. Freq. range from 1 Hz to 100K Hz. Output amplitude from 0 volts to over 6 volts (peak to peak). Uses a 12V supply or a ±6V split supply. Includes chip, P.C. Board, components & instructions.

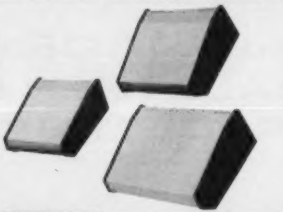
JE2206B....**$19.95**

DIGITAL THERMOMETER KIT

- Dual sensors—switching control for indoor/outdoor or dual monitoring
- Continuous LED .8" ht. display
- Range: -40°F to 199°F / -40°C to 100°C
- Accuracy: ±1° nominal
- Set for Fahrenheit or Celsius reading
- Sim. walnut case - AC wall adapter incl.
- Size: 3-1/4"Hx6-5/8"Wx1-3/8"D

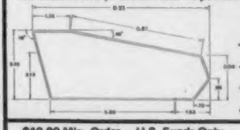
JE300 .... **$39.95**

DESIGNERS' SERIES
Blank Desk-Top Electronic Enclosures



- **High strength epoxy molded end pieces in mocha brown finish.**
- **Sliding rear/bottom panel for service and component accessibility.**
- **Top/bottom panels .080 thk alum. Alodine type 1200 finish (gold tint color) for best paint adhesion after modification.**
- **Vented top and bottom panels for cooling efficiency.**
- **Rigid construction provides unlimited applications.**

CONSTRUCTION:
The "DTE" Blank Desk Top Electronic Enclosures are designed to blend and complement today's modern computer equipment and can be used in both industrial and home. The end pieces are precision molded with an internal slot (all around) to accept both top and bottom panels. The panels are then fastened to ¼" thick tabs inside the end pieces to provide maximum rigidity to the enclosure. For ease of equipment servicing, the rear/bottom panel slides back on slotted tracks while the rest of the enclosure remains intact. Different panel widths may be used while maintaining a common profile outline. The molded end pieces can also be painted to match any panel color scheme.



Enclosure Model No.	Panel Width	PRICE
DTE-8	8.00"	$29.95
DTE-11	10.65"	$32.95
DTE-14	14.00"	$34.95

$10.00 Min. Order — U.S. Funds Only
Calif. Residents Add 6% Sales Tax
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1980 Catalog Available — Send 41¢ stamp

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7-80

The Incredible "Pennywhistle 103"

$139.95 Kit Only

The Pennywhistle 103 is capable of recording data to and from audio tape without critical speed requirements for the recorder and it is able to communicate directly with another modem and terminal for telephone "hamming" and communications. In addition, it is free of critical adjustments and is built with non-precision, readily available parts.

Data Transmission Method	Frequency-Shift Keying, full-duplex (half-duplex selectable).
Maximum Data Rate	300 Baud.
Data Format	Asynchronous Serial (return to mark level required between each character).
Receive Channel Frequencies	2025 Hz for space; 2225 Hz for mark.
Transmit Channel Frequencies	Switch selectable: Low (normal) − 1070 space, 1270 mark; High − 2025 space, 2225 mark.
Receive Sensitivity	−46 dbm acoustically coupled.
Transmit Level	−15 dbm nominal. Adjustable from −6 dbm to −20 dbm.
Receive Frequency Tolerance	Frequency reference automatically adjusts to allow for operation between 1800 Hz and 2400 Hz.
Digital Data Interface	EIA RS-232C or 20 mA current loop (receiver is optoisolated and non-polar).
Power Requirements	120 VAC, single phase, 10 Watts.
Physical	All components mount on a single 5" by 9" printed circuit board. All components included.

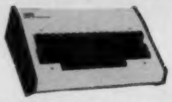
Requires a VOM, Audio Oscillator, Frequency Counter and/or Oscilloscope to align.

TRS-80 16K Conversion Kit

Expand your 4K TRS-80 System to 16K.
Kit comes complete with:
- **8 each UPD416-1 (16K Dynamic Rams) 250NS**
- **Documentation for conversion**

TRS-16K **$59.95**

JE610 ASCII Encoded Keyboard Kit



The JE610 ASCII Keyboard Kit can be interfaced into most any computer system. The kit comes complete with an industrial grade keyboard switch assembly (62-keys), IC's, sockets, connector, electronic components and a double-sided printed wiring board. The keyboard assembly requires +5V @ 150mA and −12V @ 10mA for operation. Features: 60 keys generate the full 128 characters, upper and lower case ASCII set. Fully buffered. Two user-define keys provided for custom applications. Caps lock for upper-case-only alpha characters. Utilizes a 2376 (40-pin) encoder read-only memory chip. Outputs directly compatible with TTL/DTL or MOS logic arrays. Easy interfacing with a 16-pin dip or 18-pin edge connector.

JE610 (Case not included) **$79.95**

Desk-Top Enclosure for JE610 ASCII Encoded Keyboard Kit

Compact desk-top enclosure: Color-coordinated designer's case with light tan aluminum panels and molded end pieces in mocha brown. Includes mounting hardware. Size: 3½"H x 14¾"W x 8¾"D.

DTE-AK **$49.95**

SPECIAL: **JE610/DTE-AK PURCHASED TOGETHER (Value $129.90)** **$124.95**

JE600 Hexadecimal Encoder Kit

FULL 8-BIT
LATCHED OUTPUT
19-KEY KEYBOARD

The JE600 Encoder Keyboard Kit provides two separate hexadecimal digits produced from sequential key entries to allow direct programming for 8-bit microprocessor or 8-bit memory circuits. Three additional keys are provided for user operations with one having a bistable output available. The outputs are latched and monitored with 9 LED readouts. Also included is a key entry strobe. Features: Full 8-bit latched output for microprocessor use. Three user-define keys with one being bistable operation. Debounce circuit provided for all 19 keys. 9 LED readouts to verify entries. Easy interfacing with standard 16-pin IC connector. Only +5VDC required for operation.

JE600 (Case not included) **$59.95**

Desk-Top Enclosure for JE600 Hexadecimal Keyboard Kit

Compact desk-top enclosure: Color-coordinated designer's case with light tan aluminum panels and molded end pieces in mocha brown. Includes mounting hardware. Size: 3½"H x 8¾"W x 8¾"D.

DTE-HK **$44.95**

SPECIAL: **JE600/DTE-HK PURCHASED TOGETHER (Value $104.90)** **$99.95**

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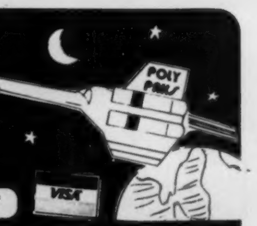

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- ☐ 10-QUAD PHONO JACKS, 4 RCA jacks on 2 x 1½" Bakelite strip, (#6249) 2.99
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- ☐ 25-MAGNETIC DISCS, Plastalloy 13/16 dia. x 1/8" discs, (#6294) 2.99
- ☐ 250-PRE-FORMED DISCS, caps w/leads for PC use, mixed values, (#2605) 2.99
- ☐ 30-PLASTIC POWERS, 25 watt, npn & pnp, 50-200 bvcbo, TO-220, (#6237) 2.99
- ☐ 100-2 WATT RESISTORS, assorted carbons, films etc. some 5%ers, (#6238) 2.99
- ☐ 24-LM-340T VOLTAGE REGULATORS, untested TO-220, may incl. 5-24V, (#2635) 2.99
- ☐ 150-POLYSTYRENE CAPS, assorted types, styles, & sizes, all good, (#2729) 2.99
- ☐ 200-COILS & CHOKES, asst. RF, OSC, IF, and peaking types, (#6283) 2.99
- ☐ 50-POWER TAB TRANSISTORS, plastic NPN, TO-220, asst. types, untested, (#2425) .. 2.99
- ☐ 24-SKINNY TRIM POTS, multi & single turn, asst. values & types, (#6285) 2.99
- ☐ 3-25A 50V BRIDGES, "block" type, with four lug-type leads, (#6311) 2.99
- ☐ 100-TTLs, 7400 series, incl. gates, flip-flops, etc. untested, (#6226) 2.99
- ☐ 5-BRASS LOCKS, with key, 1½" long, for doors, windows, etc. (#6253) 2.99
- ☐ 250-MOLEX SOCKETS, "on-a-strip", make your own pc sockets, (#6255) 2.99
- ☐ 50-MINI POTS, pc style, single turn, assorted values, (#3345) 2.99
- ☐ 20-JUMBO RED LEDS, 3V 10 mA, 100% good material, red dome lense, (#3369) 2.99
- ☐ 3-SOUND TRIGGERS, sound activated amp, SCR triggered, on 3" board, (#3625) 2.99
- ☐ 50-TRANSISTOR SOCKETS, assortment may include; TO-19,5,66,3, etc, (#3845) 2.99
- ☐ 100-CABLE TIES, 4" non-slip white plastic, like Ty-wrap, (#5218) 2.99
- ☐ 150-FEEDTHRU CAPS, assorted types & sizes, for RF, UHF, etc, (#5668A) 2.99
- ☐ 250-¼ WATT RESISTORS, asstd. carbons, carbo-films, some 5%ers, (#5797A) 2.99
- ☐ 100-PLESSY CAPS, ceramic blocks in assorted sizes & values, (#6221) 2.99
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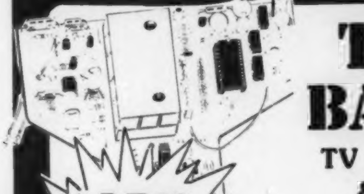

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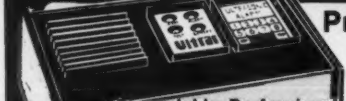

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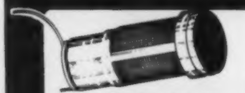

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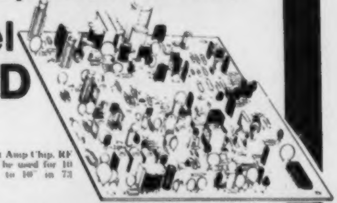

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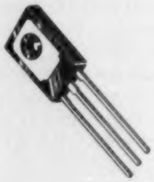

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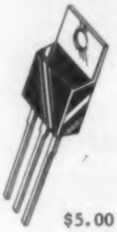

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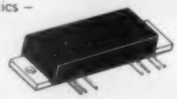

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567	Digital Readout Scope with a 6R1A Digital Unit and a 3S3 Dual Trace DC to 1GHZ Sampling Plug In and a 3T77A Sweep Plug In.	750.00
561A	DC to 10MHZ Scope with a 3S76 Dual Trace DC to 875MHZ Sampling Plug In and a 3T77A Sweep Plug In. Rack Mount	600.00
565	DC to 10MHZ Dual Beam Scope with a 2A63 Diff. and a 2A61 Diff. Plug In's	900.00
581	DC to 80MHZ Scope with a 82 Dual Trace High Gain Plug In	650.00
661	Sampling Scope with a 5T3 Timing Plug In and a 4S2 Dual Trace DC to 3.5GHZ Sampling Plug In.	575.00

Tubes

2E26	$ 5.00	4CX350FJ	$116.00	6146W	12.00
3-500Z	102.00	4CX1000A	300.00	6159	10.60
3-1000Z	208.00	4CX1500B	350.00	6161	75.00
3B28/866A	5.00	4CX15000A	750.00	6293	18.50
3X2500A3	150.00	4E27	50.00	6360	6.95
4-65A	45.00	4X150A	41.00	6907	40.00
4-125A	58.50	4X150D	52.00	6939	14.75
4-250A	68.50	4X150G	74.00	7360	12.00
4-400A	71.00	572B/T160L	39.00	7984	10.40
4-1000A	184.00	6LF6	5.00	8072	49.00
5-500A	145.00	6LQ6	5.00	8106	2.00
4CX250B	65.00	811A	12.95	8156	7.85
4CX250F/G	55.00	813	29.00	8226	127.70
4CX250K	113.00	5894/A	42.00	8295/PL172	328.00
4CX250R	92.00	6146	5.00	8458	25.75
4CX300A	147.00	6146A	6.00	8560A/AS	50.00
4CX350A	107.00	6146B/8298A	7.00	8908	9.00
				8950	9.00

MICROWAVE COMPONENTS

ARRA

2416	Variable Attenuator	$ 50.00
3614-60	Variable Attenuator 0 to 60dB	75.00
KU520A	Variable Attenuator 18 to 26.5 GHz	100.00
4684-20C	Variable Attenuator 0 to 180dB	100.00
6684-20F	Variable Attenuator 0 to 180dB	100.00

General Microwave

	Directional Coupler 2 to 4GHz 20dB Type N	75.00

Hewlett Packard

H487B	100 ohms Neg. Thermistor Mount (NEW)	150.00
H487B	100 ohms Neg. Thermistor Mount (USED)	100.00
477B	200 ohms Neg. Thermistor Mount (USED)	100.00
X487A	100 ohms Neg. Thermistor Mount (USED)	100.00
X487B	100 ohms Neg. Thermistor Mount (USED)	125.00
J468A	100 ohms Neg. Thermistor Mount (USED)	150.00
478A	200 ohms Neg. Thermistor Mount (USED)	150.00
8478A	200 ohms Balanced Neg. Thermistor Mount (USED)	175.00
J382	5.85 to 8.2 GHz Variable Attenuator 0 to 50dB	250.00
X382A	8.2 to 12.4 GHz Variable Attenuator 0 to 50dB	250.00
X885A	8.2 to 12.4 GHz Phase Shifter +/- 360°	250.00
394A	1 to 2 GHz Variable Attenuator 6 to 120dB	250.00
NK292A	Waveguide Adapter	65.00
K422A	18 to 26.5 GHz Crystal Detector	250.00
K375A	18 to 26.5 GHz Variable Attenuator	300.00
8436A	Bandpass Filter 8 to 12.4 GHz	75.00
8439A	2 GHz Notch Filter	75.00
8471A	RF Detector	50.00
342A	VHF Noise Source	100.00
X347A	8.2 to 12.4 GHz Noise Source	250.00
H532A	7.05 to 10 GHz Frequency Meter	300.00
G532A	3.95 to 5.85 GHz Frequency Meter	300.00
J532A	5.85 to 8.2 GHz Frequency Meter	300.00
809A	Carriage with a 444A Slotted Line Untuned Detector Probe and 809B Coaxial Slotted Section 2.6 to 18 GHz	175.00
809B	Carriage with a 442B Broadband Probe 2.6 to 12.4 GHz and a X810B Slotted Section	200.00
809B	Carriage with a X810B Slotted Section and a PRD 250A Detector Mount 2.4 to 12.4 GHz	200.00

Merrimac

AU-25A/	801115 Variable Attenuator	100.00
AU-26A/	801162 Variable Attenuator	100.00

Microlab/FXR

Y410A	Frequency Meter 12400 - 18000 MC	250.00
N414A	Frequency Meter 3950 - 11000 MC	350.00
X638S	Horn 8.2 - 12.4 GHz	60.00
601-B18	X to N Adapter 8.2 - 12.4 GHz	35.00
Y610D	Coupler	75.00

Narda

3095/	22909 Directional Coupler 7 to 12.4 GHz 10dB Type N	250.00
4013C-10/	22540A Directional Coupler 2 to 4 GHz 10db Type SMA	90.00
4014-10/	22538 Directional Coupler 3.85 to 8 GHz 10dB Type SMA	90.00
4014C-6/	22876 Directional Coupler 3.85 to 8 GHz 6dB Type SMA	90.00
4015C-10/	22539 Directional Coupler 7.4 to 12 GHz 10dB Type SMA	95.00
4015C-30/	23105 Directional Coupler 7 to 12.4 GHz 30dB Type SMA	95.00
3044-20	Directional Coupler 4 to 8 GHz 20dB Type N	125.00
3040-20	Direcitonal Coupler 240 to 500 MC 20dB Type N	125.00
3041-20	Directional Coupler 500 to 1000 MC 20dB Type N	125.00
3043-20/	22006 Directional Coupler 1.7 to 4 GHz 20dB Type N	125.00
3003-10/	22011 Directional Coupler 2 to 4 GHz 10dB Type N	75.00
3003-30/	22012 Directional Coupler 2 to 4 GHz 30dB Type N	75.00
3042-20	Directional Coupler 950 to 2 GHz 20dB Type N	125.00
3043-30/	22007 Directional Coupler 1.7 to 3.5 GHz 30dB Type N	125.00
22574	Directional Coupler 2 to 4 GHz 10dB Type N	125.00
3033	Coaxial Hybrid 2 to 4 GHz 3dB Type N	125.00
3032	Coaxial Hybrid 950 to 2 GHz 3 dB Type N	125.00
784/	22380 Variable Attenuator 1 to 90dB 2 to 2.5 GHz Type SMA	550.00
22377	Waveguide to Type N Adapter	35.00
720-6	Fixed Attenuator 8.2 to 14.4 GHz 6 dB	50.00
3503	Waveguide	25.00

PRD

U101	12.4 to 18 GHz Variable Attenuator 0 to 60dB	300.00
X101	8.2 to 12.4 GHz Variable Attenuator 0 to 60dB	200.00
C101	Variable Attenuator 0 to 60dB	200.00
205A/367	Slotted Line with Type N Adapter	100.00
195B	8.2 to 12.4 GHz Variable Attenuator 0 to 50dB	100.00
185BS1	7.05 to 10 GHz Variable Attenuator 0 to 40dB	100.00
196C	8.2 to 12.4 GHz Variable Attenuator 0 to 45dB	100.00
170B	3.95 to 5.85 GHz Variable Attenuator 0 to 45dB	100.00
588A	Frequency Meter 5.3 to 6.7 GHz	100.00
140A,C,D,E	Fixed Attenuators	25.00
109J,I	Fixed Attenuators	25.00
WEINSCHEL ENG.	2692 Variable Attenuator +30 to 60dB	100.00

COMPUTER I.C. SPECIALS

MEMORY	DESCRIPTION	PRICE
2708	1K x 8 EPROM	$ 7.99
2716/2516	2K x 8 EPROM 5Volt Single Supply	20.00
2114/9114	1K x 4 Static RAM 450ns	6.99
2114L2	1K x 4 Static RAM 250ns	8.99
2114L3	1K x 4 Static RAM 350ns	7.99
4027	4K x 1 Dynamic RAM	3.99
4060/2107	4K x 1 Dynamic RAM	3.99
4050/9050	4K x 1 Dynamic RAM	3.99
2111A-2/8111	256 x 4 Static RAM	3.99
2112A-2	256 x 4 Static RAM	3.99
2115AL-2	1K x 1 Static RAM 55ns	4.99
6104-3/4104	4K x 1 Static RAM 320ns	14.99
7141-2	4K x 1 Static RAM 200ns	14.99
MCM6641L20	4K x 2 Static RAM 200ns	14.99
9131	1K x 1 Static RAM 300ns	10.99

C.P.U.'s ECT.

MC6800L	Microprocessor	13.80
MCM6810AP	128 x 8 Static RAM 450ns	3.99
MCM68A10P	128 x 8 Static RAM 360ns	4.99
MCM68B10P	128 x 8 Static RAM 250ns	5.99
MC6820P	PIA	8.99
MC6820L	PIA	9.99
MC6821P	PIA	8.99
MC68B21P	PIA	9.99
MCM6830L7	Mikbug	14.99
MC6840P	PTM	8.99
MC6845P	CRT Controller	29.50
MC6845L	CRT Controller	33.00
MC6850L	ACIA	10.99
MC6850P	ACIA	4.99
MC6852P	SSDA	5.99
MC6852L	SSDA	11.99
MC6854P	ADLC	22.00
MC6860CJCS	0-600 BPS Modem	29.00
MC6862L	2400 BPS Modem	14.99
MK3850N-3	F8 Microprocessor	9.99
MK3852P	F8 Memory Interface	16.99
MK3852N	F8 Memory Interface	9.99
MK3854N	F8 Direct Memory Access	9.99
8008-1	Microprocessor	4.99
8080A	Microprocessor	8.99
Z80CPU	Microprocessor	14.99
6520	PIA	7.99
6530	Support For 6500 series	15.99
2650	Microprocessor	10.99
TMS1000NL	Four Bit Microprocessor	9.99
TMS4024NC	9 x 64 Digital Storage Buffer (FIFO)	9.99
TMS6011NC	UART	9.99
MC14411	Bit Rate Generator	11.99
AY5-4007D	Four Digit Counter/Display Drivers	8.99
AY5-9200	Repertory Dialler	9.99
AY5-9100	Push Button Telephone Diallers	7.99
AY5-2376	Keyboard Encoder	19.99
AY3-8500	TV Game Chip	5.99
TR1402A	UART	9.99
PR1472B	UART	9.99
PT1482B	UART	9.99
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8251	Communication Interface	9.99
8228	System Controller & Bus Driver	5.00
8212	8 Bit Input/Output Port	5.00
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MC14412	Low Speed Modem	14.99
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MC1489L	RS232 Receiver	1.00
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MC1330P	Low Level Video Detector	1.50
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MC1733L	LM733 OP Amplifier	2.40
LM565	Phase Lock Loop	2.50

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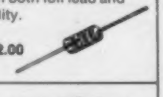

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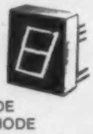

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NOW A SUPER READOUT AT A SUPER BUY! These are **factory fresh prime** LED readouts, not seconds or rejects as sold by others. Compare our price and send for yours today, but hurry, the supply is limited!

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Hfe 25-100
@ 1.5A
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THE PERFECT TRANSFORMER

117VAC primary. 12VAC secondary @ 200ma Great for all you CMOS, or low power TTL projects. PC board mount.

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Size: 1.5" W x 1.25" D x 1.25" H

AY3-8910 PROGRAMMABLE SOUND GENERATOR

The AY3-8910 is a 40 pin LSI chip with three oscillators, three amplitude controls, programmable noise generator, three mixers, an envelope generator, and three D/A converters that are controlled by 8 BIT WORDS. No external pots or caps required. This chip hooked to an 8 bit microprocessor chip or Buss (8080, Z80, 6800 etc.) can be software controlled to produce almost any sound. It will play three note chords, make bangs, whistles, sirens, gunshots, explosions, bleets, whines, or grunts. In addition, it has provisions to control its own memory chips with two IO ports. The chip requires +5V @ 75ma and a standard TTL clock oscillator. A truly incredible circuit.

$14.95 W/Basic Spec Sheet (4 pages)
60 page manual with S-100 interface instructions and several programming examples, **$3.00 extra**

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Provides cheap insurance for your expensive equipment. Trip voltage is adjustable from 3 to 30 volts. Overvoltage instantly fires a 25A SCR and shorts the output to protect equipment. Should be used on units that are fused. Directly compatible with the PS-12 and PS-14. All electronics supplied. Drilled and plated PC board.

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Invisible Beam Works Like A Photo Electric Eye. **COMPLETE KIT**. All Parts & PC Board. Use Up To 25 Ft. Apart.

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Optional entry delay and Alarm Timeout Circuit will source or sink up to 200 MA DC.

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AUTO/VAN CLOCK KIT

- 12 Hr. Format
- 6 Digit ½" LED Readouts
- Quartz XTAL Timebase
- Alarm & Snooze Options
- Noise Filtering
- Easy Assembly • 12 VDC
- 4 5/8" x 3" x 1 1/2"
- All Parts!

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ZULU II CLOCK KIT

WITH CALENDAR AND NOX™ CIRCUIT

X-RATED!

X-TRA VALUE: All the components and high quality plated G-10 PC Boards are provided.

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Custom High Impact Molded Case with Ruby Lens. Available in Blue or Tan.

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117 VAC to 12 VAC Transformer.

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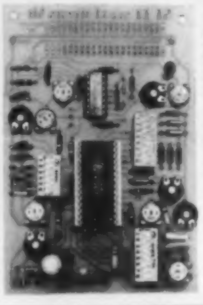
*9V Battery Not Included



Sound Effects Kit

The **SE-01 Sound Effects Kit** is a complete kit; all you need to build a programmable sound effects machine except a battery and speaker. Our kit is designed to really ring out the **TI 76477** Sound Chip. Only the SE-01 provides you with additional circuitry that includes a **PULSE GENERATOR, MUX OSCILLATOR and COMPARITOR** to make more complex sounds a snap. We help you in building the kit with a clear, easy-to-follow construction manual and we show you how to easily program the unit. Other dealers will sell you the chip or a "kit" of parts but you are on your own to do the most difficult part...make neat sounds! Within a short time after you build the SE-01 you can easily create **Gunshots, Explosions, Space Sounds, Steam Trains** and much more. We think the Bullet SE-01 is the best deal on the market but don't ask us, — ask the **15,000** happy SE-01 owners!

Complete Kit With Quality Plated PC Board **$17.50**
(Less battery & speaker)

Users Group Notes: Includes additional programming charts plus quarterly updates **$5.90**

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SMALL. SINGLE HYBRID IC AND COMFONENTS FIT ON A 2" x 3" PC BOARD (INCLUDED). RUNS ON 12VDC. GREAT FOR ANY PROJECT THAT NEEDS AN INEXPENSIVE AMP. LESS THAN 3% THD @ 5 WATTS. COMPATIBLE WITH SE-01 SOUND KIT. **$5.95**

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CD4046	PLL CMOS	.99
LM3302	Quad Comparator	.89
2SC 1846	High Freq. NPN TO-92	6/1.00
MPS A 20	NPN General Purpose	8/1.00
TL490	Bar/Graph Driver w/specs	2.50
7812	12V 1A Regulator	.99
7805	5V 1A Regulator	.99
78M05	5V ½A Reg. TO-5 (Hse #)	.60
LM3911	Temp. Transducer w/specs	1.15
555	Timer IC	.49
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IL-1	Opto Isolator w/specs	.60
LM380	2W Audio IC w/specs	.50
LM377	Dual LM380 w/specs	1.09
TIP-30	PNP Power TO-220	3/1.00

NEW! MUSIC FOR YOUR EARS

Bullet's **Electronic Music Machine™ Kit** has a single **28 Pin Microprocessor Chip with ROM** that has been programmed to play the first 6 to 10 notes of the **25 popular tunes** listed below. Each tune can easily be addressed individually or played sequencially at the push of a button. The 3 chime sequences are activated at any time by separate switch closures so when used as a doorbell, one door can play songs while two others will play different chimes. The unit has a **5 watt audio Amp and will run on either 12VAC or 12VDC.** Optional 117VAC transformer is available. Construction is very simple, works with any 8 or 16 ohm speaker, or norn speaker. (Not Included.) Tunes can be remotely programmed using a single rotary switch. (not included), if desired.

Complete Kit $16.95 Transformer $1.35
For Operation on 117VAC

Tunes: Toreador * William Tell * Hallelujah Chorus * Star Spangled Banner * Yankee Doodle * America, America * Deutschland Leid * Wedding March * Beethoven's 5th and 9th * Hell's Bells * La Vien En Rose * Star Wars Theme * Clementine * Augustine * Jingle Bells * God Save The Queen * Colonel Bogey * Marseillaise * O Sole Mio * Santa Lucia * The End * Blue Danube * Brahms Lullaby * Westminister Chime * Simple Chime * Descending Octave Chime.

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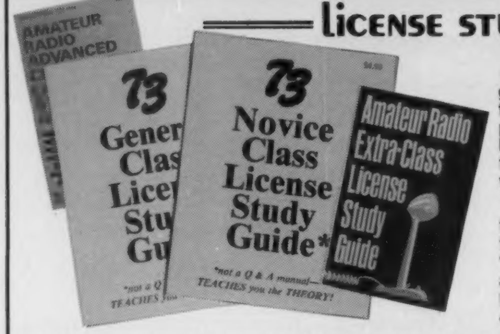
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● **EXTRA CLASS LICENSE STUDY GUIDE**—SG1080—Before going for your 1 × 2 call, it pays to be a master of the Extra class electronics theory. This study guide is the logical extension of the *73* theory course. All the theory necessary to pass the exam is presented. Antennas, transmission lines, swr are discussed, as well as noise, propagation, and specialized communication techniques. This book is not a classroom lecture or memorization guide, but rather a logical presentation of the material that must be *understood* before attempting the Extra exam. Save yourself a return trip to the FCC and try the *73* method first! $5.95.*

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● **NOVICE THEORY TAPES**—CT7300—Startling Learning Breakthrough. You'll be astounded at how really simple the theory is when you hear it explained on these tapes. Three tapes of theory and one of questions and answers from the latest Novice exams give you the edge you need to breeze through your exam. *73* is interested in helping get more amateurs, so we're giving you the complete set of our tapes for the incredibly low price of **ONLY $15.95.***

Scientists have proven that you learn faster by listening than by reading because you can play a cassette tape over and over in your spare time—even while you're driving! You get more and more info each time you hear it. You can't progress without solid fundamentals. These four hour-long tapes give you all the basics you'll need to pass the Novice exam easily. You'll have an understanding of the basics which will be invaluable to you for the rest of your life! Can you afford to take your Novice exam without first listening to these tapes? Set of 4—$15.95.*

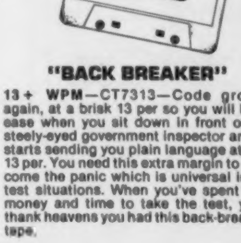
These tapes were made previous to recent changes in FCC rules. These minor changes do not affect the *theory* involved. A new set of tapes reflecting these rule changes is being developed. Expected availability is December 1980.

SSTV

● **SLOW SCAN TELEVISION TAPE**—CT7350—Prize-winning programs from the 73 SSTV contest. Excellent for Demo! $5.95.*

73 CODE TAPES

Any Four Tapes For $15.95!*
$4.95 Each!*



"GENESIS"

5 WPM—CT7305—This is the beginning tape for people who do not know the code at all. It takes them through the 26 letters, 10 numbers and necessary punctuation, complete with practice every step of the way using the newest blitz teaching techniques. It is almost miraculous! In one hour many people—including kids of ten—are able to master the code. The ease of learning gives confidence to beginners who might otherwise drop out.

"THE STICKLER"

5+ WPM—CT7306—This is the practice tape for the Novice and Technician licenses. It is made up of one solid hour of code, sent at the official FCC standard (no other tape we've heard uses these standards, so many people flunk the code when they are suddenly—under pressure—faced with characters sent at 13 wpm and spaced for 5 wpm). This tape is not memorizable, unlike the zany 5 wpm tape, since the code groups are entirely random characters sent in groups of five.

"BACK BREAKER"

13+ WPM—CT7313—Code groups again, at a brisk 13 per so you will be at ease when you sit down in front of the steely-eyed government inspector and he starts sending you plain language at only 13 per. You need this extra margin to overcome the panic which is universal in the test situations. When you've spent your money and time to take the test, you'll thank heavens you had this back-breaking tape.

"COURAGEOUS"

20+ WPM—CT7320—Code is what gets you when you go for the Extra class license. It is so embarrassing to panic out just because you didn't prepare yourself with this tape. Though this is only one word faster, the code groups are so difficult that you'll almost fall asleep copying the FCC stuff by comparison. Users report that they can't believe how easy 20 per really is with this fantastic one hour tape.

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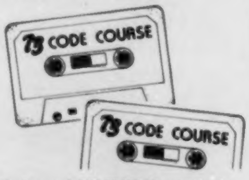

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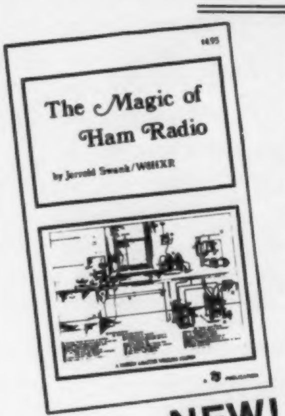

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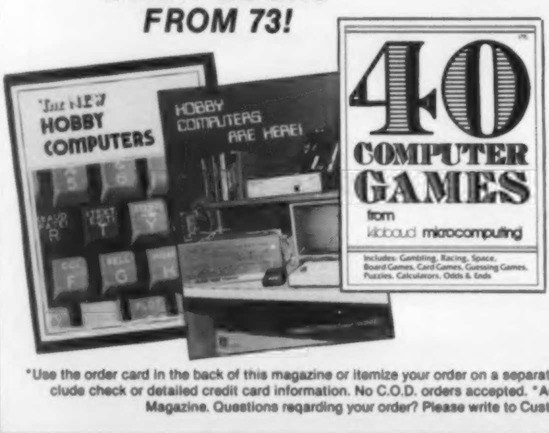
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ARGENTINA	21	21	14	14	7A	7	14	21	21A	21A	21A	21A
AUSTRALIA	21	14	14	7B	7B	7B	7B	7B	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	14	14	14	21	21	21	14A
HAWAII	21	14	14	7	7B	7B	7	14	14	14	21	21
INDIA	14	14	7B	7B	7B	7B	14	14	14	14	14	14
JAPAN	14A	14	14	7B	7B	7B	7	7	7	14	14	14
MEXICO	21	14	14	7	7	7	7	14	14	14	21	21
PHILIPPINES	14A	14	14B	7B	7B	7B	7B	7A	14	14	14	14
PUERTO RICO	14	14	14	7	7	7	14	14	14	14	14A	14A
SOUTH AFRICA	14	7B	7B	14	14	14A	21	21	21A	21A	14A	14
U. S. S. R.	7A	7	7	7	7	14	14	14	14	14A	21	14
WEST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	7A	7	14	21	21A	21A	21A	21A
AUSTRALIA	21	14A	14	14	14	7B	7B	7B	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	7	7	14	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	7	14	14	14	14	14A	14
HAWAII	21	21	14	14	7	7	7	14	14	21	21	21
INDIA	14	14	14	7B	7B	7B	7B	7B	14	14	14	14
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SOUTH AFRICA	14	7B	7B	7B	7B	14B	14A	21	21	21	14A	14
U. S. S. R.	7A	7	7	7	7	7B	14	14	14	14	14	14

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GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	14	7	7	7	7	7	14	14	14	14
ARGENTINA	21	21	14	14	7A	7	7	14	21A	21A	21A	21A
AUSTRALIA	21A	21A	21	14A	14	14	14	14	7B	7B	14A	21
CANAL ZONE	21	14A	14	14	7	7	7A	21	21	21A	21A	21A
ENGLAND	14	7	7	7	7	7	7B	14	14	14	14	14
HAWAII	21A	21A	21	14	14	14	7A	14	14	21	21	21
INDIA	14	14	14	14	7B	7B	7B	7B	14	14	14	14
JAPAN	21	14A	14	14	14	7	7	7	7	14	14	14A
MEXICO	21	14	14	7	7	7	7	14	14	14	21	21
PHILIPPINES	21	21	14A	14	14	14B	7B	7A	14	14	14	14A
PUERTO RICO	21	14A	14	14	7	7	7	14	14	14A	21	21
SOUTH AFRICA	14	7B	7B	7B	7B	7B	14	14	14A	14A	14A	14
U. S. S. R.	7A	7	7	7	7	7B	7B	14	14	14	14	14
EAST COAST	21	14	14	7	7	7	7A	14	14	14A	21	21

A = Next higher frequency may also be useful
B = Difficult circuit this period
F = Fair
G = Good
P = Poor
SF = Chance of solar flares

august

sun	mon	tue	wed	thu	fri	sat
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